THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1911 EDITION

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THE CORNER TURNED.

FOR several weeks past a number of our pages have been occupied with the experiences of the electricity supply companies of the London district during the year 1910. We believe that those who are on the look-out for definite indications of improvement in the electrical industrial position will have found the directors' reports and chairmen's speeches of greater interest than any emanating from the same sources since the introduction of the metallic-filament lamp. The intervening period has undoubtedly been one of some anxiety; Sir Henry Mance, addressing the Oxford company's shareholders, says that in 19 years there have not been more anxious times than those of the last two years at Oxford. But the conviction to which we have given confident expression from the very first—that the metallic lamp would be a boon to electricity suppliers before long—has been fully proved to be correct.

We have arrived at that important stage when engineers and commercial men are able to see clearly that the corner has been turned, and to say without hesitation that the future has only prosperity in sight. Here and there the 1910 results have been such as to admit of a small increase in the dividends paid on the ordinary shares; in no case has there been a reduction. It is true that in one instance a reserve specially set aside for meeting the situation was drawn upon, and it is also to be noted that in one area the "saturation" of past progress left few new consumers to be obtained to compensate for the economies of those already connected. Speaking for the majority of the companies, however, there is now to be expected a return to the former normal rate of advance. The financial world, which, as we have shown again and again, has been neglecting electricity supply securities, has been waiting to see what would happen, and it has not been slow to appreciate the significance of the signs that the period of anxiety is past.

If the market had had its hopes entirely fulfilled, there would have been bigger dividends all round and a much greater appreciation of values, but after so lengthened a depression or stagnation it is satisfactory to note the measure of improvement that has taken place, for it means that the public is ready to interest itself in home electrical securities again when there are no haunting spectres about. And the higher securities stand in the public mind, the greater should be the readiness to subscribe for new issues either for existing or for entirely new electrical enterprises. A substantial all-round improvement in the financial position of electric lighting, power, and tramway companies should be followed by a more friendly attitude of financiers and banks towards electrical enterprises in which British engineers are interested. Greater co-operation between finance and the electrical industry has long been desired in the interests of our electrical trade generally, and if the bright prospects which are now spread out before us lead in that direction, the "turning the corner" process will not only mean bigger dividends for holders of certain classes of shares but greater activity in electrical manufacturing.

As Mr. Braithwaite remarked to shareholders of the County of London Company early this week, anything which

tends to make electricity cheap is in the interests of the industry at large, and the metallic lamp is "going to do great things" for that industry. He says that there is every prospect of 1911 being the best year that his company has had for a long time. Sir William Crookes at the Notting Hill meeting said that that company's revenue in 1910 was the most satisfactory that they had ever reported since the formation of the company 23 years ago.

The Metropolitan Electric Supply Co.'s experience has been that the diminution of consumption, which commenced two years ago, went on pretty rapidly until it culminated about a year ago. At first the consumer seemed to be willing to have the same amount of light and save in his bills, but now, in this and other areas, it is being found that the individual consumer is increasing his consumption. In the first quarter of 1910 the Metropolitan decrease was at its worst—about £6,000; next quarter, in place of a decrease, there was a small rise; in the third quarter, a quite appreciable increase; in the last quarter a substantial rise, and in the first quarter of 1911 this increase continues. Some consumers who used to pay £15 now only pay £5, but the company is getting as large an increase of consumers as ever it secured. Our readers will be able to examine the statements of the different companies—they speak eloquently for themselves.

The metallic lamp stimulated economies in various directions, so that the cost of production per unit is less, not only during the "anxious" period, but afterwards when the corner has been turned. The replacement of old and comparatively extravagant sets of plant by efficient turbo-generators, the overhauling of steam-raising equipments, the adoption of improved stoking and condensing systems, the reorganisation of commercial departments, the keener publicity and canvassing efforts, the slackening down in new capital expenditure concurrently with the lessened consumption, the growth of the power load—all these and some other things that might be mentioned have been taking place during the period of changing-over from the old lamp to the new, and they are all alterations which will bear fruit in the future. The introduction of the metallic-filament lamp has also tended to improve the load factor by reducing the relative importance of the peak load, thus increasing the effective capacity of the plant and mains, and has imparted a new impetus to the movement in the direction of electric street lighting, which in the future will become continually more important and advantageous to the supply authorities.

Therefore it comes about that the companies are really in a stronger position to-day than they were when the carbon-filament lamp was their great devourer of current. They are better prepared for the competition with the rival illuminant.

Electric Car or Motor-'Bus?

With the recent absorption of the Great Eastern Omnibus Co. by the London General, the latter concern becomes practically master of the omnibus business of Greater London.

That some such amalgamation of motor-'bus interests would eventually be necessary, if the motor-'bus was to survive and continue on any extended and competitive basis, was almost a foregone conclusion; but for its accomplishment to be in any way construed as a preliminary nail in the coffin of the London tramways, requires a stretch of imagination such as one rarely finds except in the neighbourhood of Carmelite Street.

Yet every excuse must be made for the *Daily Mail* scribe who writes on the motor-'bus, fettered as he is by the knowledge that "from the very first the *Daily Mail* foresaw its vast possibilities, and prophesied its ultimate success," for with such a prophecy to fulfil, it would be criminal not to make hay while the sun shines, while amalgamation fills the air, and share values indulge in a daily rise—besides, the opportunity might not occur again.

The writer, however, states that the running costs of the 'bus are falling, while those of the tramway are rising—which we very much question—and adduces a speech by the chairman of the L.C.C., showing that the receipts per car-mile on the Council's tramways have fallen from 12·16d. to 10·37d., as evidence of a decline in tramway revenue. Unfortunately for our contemporary, its last conclusion is opposed to fact; a fall in average receipts per car-mile within the limits mentioned, in the case of an average tramway undertaking, is more generally a sign of increased gross revenue and profits following on increased car-mileage and traffic.

This point in tramway economics was ably dealt with by the late Mr. J. R. Salter at the Dublin Congress last year; he showed the influence of increasing car-mileage in reducing average standing charges and therefore total costs, which at the same time corresponds with some reduction in average revenue, although a greater gross profit may result. Although there is little in common between the L.C.C. tramways and those of the Dublin United Co., we note in passing that the latter concern pays its shareholders a steady 6 per cent. dividend with only 9d. per car-mile average receipts. We wonder whether any omnibus company would do as much.

Our contemporary touches on the increasing energy consumption per car-mile on tramways, as shown by the Board of Trade 1909-10 returns, and contrasts this with decreasing power costs in the case of the motor-'bus. Here, again, a little more knowledge of tramway matters would be valuable in Carmelite Street. We would suggest that the gradually extending use of larger cars and the general adoption of top covers, with resulting increase in weight to be moved, amply explain a small average increase in energy consumption per car-mile, and incidentally emphasise the increasing demand for the form of locomotion which has, so far, falsified the prophetic vision of our contemporary.

The top-covered tramway car well repays its slight extra demand on the power station, in this climate. Ask any would-be motor-'bus passenger on a wet or cold day.

One might go further into this matter, and show that the average energy consumption per ton-mile on our tramways is probably on the decrease, owing to the more general adoption of meters on the cars and the more careful driving which results.

Our contemporary makes a better case for the obstruction caused by tramway cars, although it is by no means certain that there would be less obstruction if another three or four thousand motor-'buses took the place of the existing tramway cars and gave the same frequent service on our main traffic arteries; indeed, it is questionable whether the very frequent stoppages at the roadside necessary to deal with the present tramway traffic would not result in reducing the average speed of the 'buses below that of the present tramway cars, which have a recognised track. If the recent Board of Trade report on London traffic is any guide, it shows that in 1909 some 2,900 'buses carried about 311 million passengers, while 14 per cent. fewer tramway cars dealt with 120 per cent. more passengers. And the mention of the roadside, reminds us that our contemporary trembles for the safety of the unlucky tramway passenger, who has to negotiate the swiftly-moving motor traffic (presumably including motor-'buses) in reaching the pavement from the tramway in the centre of the road. It says:—"Here the motor-omnibus has an inestimable advantage . . . it can bring its passengers to the pavement. This superiority is a matter to which attention was drawn years ago in the *Daily Mail*. . . . Moreover, each widening of the roadway will . . . . increase the danger zone to be covered by the foot passenger before he reaches the safety of the pavement after descending from the tramcar." Wonderful! And yet we seem to see ourselves, after alighting from a motor-'bus, often having to cross the whole of the road in order to get to the other side, while the lucky tramway passenger has only half that distance to cover from the centre of the road—and, borrowing for a brief space our contemporary's prophetic vision, we find ourselves in the halcyon days, when the motor-'bus reigns supreme, dodging an array of charging 'buses (of greater speed than the tramcar, *D.M.*), and pursuing whatever course the vagaries of the drivers may dictate as to direction or stopping (flexibility in these matters an advantage, *D.M.*); and we may even regret the passing of the

tramcar, which, despite its faults, reduced the number of passenger vehicles on the streets by one-half, followed its own track in the centre of the road, and could be boarded at definite stopping places.

Corrosion of Metals.

A recently issued report of the Corrosion Committee of the Institute of Metals should be studied by those to whose lot falls the design or working of surface condensers, for some curious facts have been elucidated. One of these facts is that electro-deposited copper is not so capable of withstanding corrosion as is ordinary best selected copper, and Muntz metal is better than this. Apparently copper alloys are possessed of some quality lacking in pure copper. But a point of, perhaps, even more interest is that thick tubes lose less by corrosion per unit of surface than do thin tubes, and it is advised that condenser tubes should be made twice as thick as they are now made, for they would not merely repay the extra cost by the longer time they would place between repair periods, but actually more life per pound weight would be got out of them. And the labour of fixing a heavy tube is only the same as that of fixing a lighter tube. It is recommended, too, that though the life of tinning is but short, tinned tubes should always be used. The author of the report is Mr. Bengough, and he says that he has no hesitation in stating that the primary process of corrosion of a metal or alloy is the entrance of the metal into solution as ions. This applies equally to chemical action, as when zinc dissolves in an acid; to a combined attack by a corrosive liquid and the atmosphere; and to electrochemical corrosion.

A general set of conclusions drawn from laboratory experiments on copper-zinc alloys with various salt solutions, including common salt and synthetic sea water—why not have used actual sea water?—is to the effect that copper is more corrodible than any of the brasses. The rate of corrosion falls off gradually with increase of zinc till about 36 per cent. of zinc is reached. Rapid falling-off in the corrosion rate then goes on up to 50 per cent. of zinc.

With less than 36 per cent. of zinc the corrosion products have the same composition as the test piece. With more than 50 per cent. zinc the corrosion product is pure zinc. But these conclusions, drawn from experiments by a Mr. Lincoln, appear to be somewhat vitiated by the fact that he scraped off the tube all loose material, and would obviously get into the solution the copper left behind by the dissolving zinc.

The author suggests experiments on corrosion with a view to gaining further information that may lead to a more complete knowledge of the subject. Corrosion is perhaps the worst enemy which engineers have to combat, for no sooner is any metallic structure completed or a machine set to work than corrosion begins to set a limit to its life.

Competition in Germany.

The directors of the Elektrotechnische Fabrik Rheydt (Max Schorch & Co.) A.G., of Rheydt, propose to pay a dividend of 8 per cent. for 1910, as compared with 7 per cent. in the preceding year, the net profits being £10,100, as against £8,900 in 1905. In forming an opinion of the net profits, the company's report states that it has to be considered that in consequence of the peculiar situation of the electrical industry, prices for manufactures have constantly fallen, with the result that orders, at least for normal types, can only be obtained at present at prices which mostly produce a loss. The reason for this condition of business lies in the circumstance, it is declared, that the large electrical firms wish to secure a monopoly for themselves, and they therefore bring prices to such a position that the smaller and less financially strong companies are thereby compelled either to amalgamate with the large firms or to liquidate. During the past year three firms have in this way lost their existence. The Rheydt company is in the comparatively fortunate position of not being affected by the action of the large firms in the same measure, as the company, at an appropriate period, devoted itself to the production of specialities, the orders for which cannot be diverted by underselling. The types of machine which had been evolved for the weaving industry have admirably answered the purpose. As a consequence, orders from all over the world reached the company in the past year for these specialities, for which several large orders have also been received from weaving mills in the present year, whilst the special types developed for the mining industry have continued to enjoy a good reputation.

Reform in Engineering Design.

The strictures recently passed by our contemporary the *Engineer* upon Prof. Nicolson's boiler have aroused that gentleman's wrath. He asserts that he has ventured to advocate the use of more advanced theoretical methods. He then proceeds to claim as the results of such methods improved details of steam turbines, of centrifugal pumps, of turbo-compressors, and of large gas and oil engines, in all of which cases he says British firms are working under German licences. Now, seriously, can Prof. Nicolson substantiate these claims? First, as to the steam turbine; to begin with, this is a British invention, and we have yet to learn that any specially better improvements in design have been made by Germans than by the inventor Mr. Parsons himself, or some of our American friends. Now as to centrifugal pumps, as long as 16 years ago an old 5-in. Gwynne pump, running on an artesian well, was found to lower the water from the pump centre gradually to a distance of over 31 ft. before the pump ceased to deliver water. Can the best modern German pump show a better result than this second-hand Gwynne pump? Can the Professor cite anything special in German turbo-compressors?

As to large gas engines, it is perfectly true that Germany has obtained a lead in these, but she has done so simply because she chose to make use of those huge volumes of waste gases from blast furnaces, which she was taught to utilise by an Englishman. Had our British ironmasters done likewise, the British gas-engine makers would have been as far ahead of German makers as they are in small engines.

Prof. Nicolson does not seem to use the sense of proportion. He hammers on the physical fact that high velocity of hot gases makes for efficiency of heat transmission to metal surfaces. But everybody knows this already, and knows that high velocity means high resistance and fans and friction, and an expense that may imply commercial loss, just as very high steam pressures imply expense in maintenance or serious leakage losses which may more than balance the gains from the high pressure.

The Professor claims, apparently, to know more about coal combustion than other people whom he dubs the Old Guard, yet in using refractory lined furnaces, what is he doing but following on the lines advocated for 20 years in these columns?

Since it is on boilers that all the Professor's energy is being expended, will he tell us why it is that locomotive boilers all over the world are modelled so closely on British practice? Why was it found that in Egypt the Belgian locomotives only became equal to the British after retubing, while the American engines were so uneconomical that they would have been commercially a loss if handed over as a gift?

Joule, who experimented on condenser tubes 50 years ago, showed clearly the effect of water velocity in improving the rate of steam condensation. His experiments also showed that the velocity of steam inside the tubes mattered but little. Counter current of steam and water also appeared little or no better than concurrent working. His findings are applicable to-day, and have been known for 50 years, but it is doubtful if his best proved velocities could be employed in practice. Dr. Nicolson does not allow sufficient weight to the circumstances of engineering. He adds his sneers to those of the foreigner, but we venture to say that in all matters of engineering we have in Great Britain, in every branch, men quite able and willing to do the highest scientific work.

DIRECT AND ALTERNATING-CURRENT ELECTROMAGNETS.

By P. R. FRIEDLAENDER.

Considerable discrepancies have often been noticed between the pull exerted by an electromaget when excited with direct current and that exerted by the same magnet (or one of the same dimensions, only modified to avoid eddy-current losses) when used on a single-phase alternating-current circuit at the same current.

In many cases, no doubt, this is partly due to the effect of iron saturation, but, quite apart from this factor, considerable differences still occur.

Theoretically, since the pull of a magnet on its armature or keeper is proportional to the square of the flux density in the gap between them—

$$\text{Pull in dynes} = \frac{\left(\text{Flux density per sq. cm.}\right)^2 \times \text{Total area of pole face in sq. cm.}}{8\pi},$$

the *average* pull of a magnet when used on A.C. should be exactly the same as the steady pull when it is used on D.C., provided that the square root of the mean square value of the flux density with A.C. is the same as the steady flux density with D.C. Now, if the iron is quite unsaturated and the distorting effect of hysteresis is kept negligibly small, the time curve of flux density on A.C. will be of the same shape as the time curve of the alternating current itself, and, consequently, if the $\sqrt{MS}$ value of the alternating current is made the same as the steady value of the direct current, the $\sqrt{MS}$ value of the A.C. flux density will be the same as the steady value of the D.C. flux density, and the average pull on A.C. should be exactly the same as the steady pull on D.C.

In practice this equality of pulls is seldom attained, even when the conditions as to saturation and hysteresis are fully complied with, for the simple reason that the length of the working air-gap varies periodically when the alternating current is in use, and so interferes with the shape of the time curve of flux. This periodic variation of air-gap is generally made very obvious by the vibration and noise set up by such magnets, especially just before the armature is attracted or released.

Suppose a certain electromagnet is employed to attract an armature, with a certain weight attached, across an air-gap of length L. A certain direct current A is found to cause the armature just to lift. If, now, an alternating current of A $\sqrt{MS}$ amperes is applied instead of the direct current, with the armature set at the same distance L, the pull on it will vary from 0 to a maximum and back to 0 twice every period. Assuming a sine wave of current and quite unsaturated iron, the maximum pull will be that corresponding to a current of $\sqrt{2} \times$ A amperes, or a flux density of $\sqrt{2} \times$ the D.C. flux density, and, as the pull increases as the square of the flux density, the maximum instantaneous pull on A.C. will be 2 × pull on D.C. During the intervals of high pull (*i.e.*, from x to y in fig. 1), the attractive pull of the magnet will be in excess of the load on the armature, and the armature will consequently lift more or less rapidly, according to the mass to be accelerated, and will approach the poles slightly. During the intervals of low pull (y to z, fig. 1) the attractive pull is *less* than the load on the armature, and, consequently, the armature tends to move away, and is only prevented from doing so by the stops used to set the air-gap at length L to begin with. As any *increase* in L is thus rendered impossible, the net result over the whole period is equivalent to the use of a steady air-gap length somewhat less than L. Consequently, the pull with A.C. is somewhat greater than with D.C.—the exact excess depending on : (1) the mass of the armature and load ; (2) the shape of the time curve of flux on A.C. ; (3) the actual value of L (*i.e.*, the percentage change in flux produced by

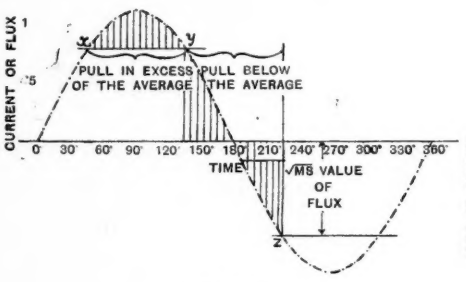
CURRENT OR FLUX
PULL IN EXCESS OF THE AVERAGE
PULL BELOW THE AVERAGE
0 30 60 90 120 150 180 210 240 270 300 330 360
TIME
√MS VALUE OF FLUX

Fig. 1.

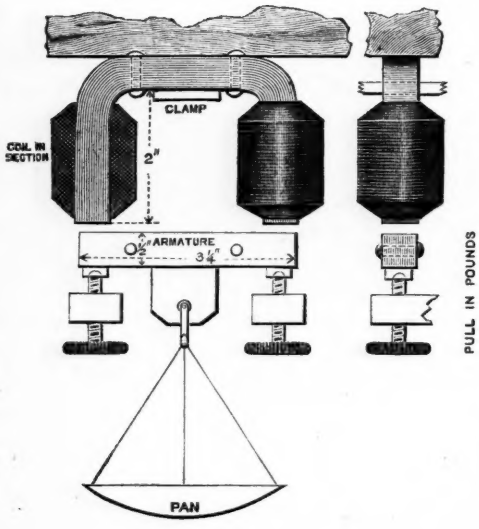

Fig. 2.

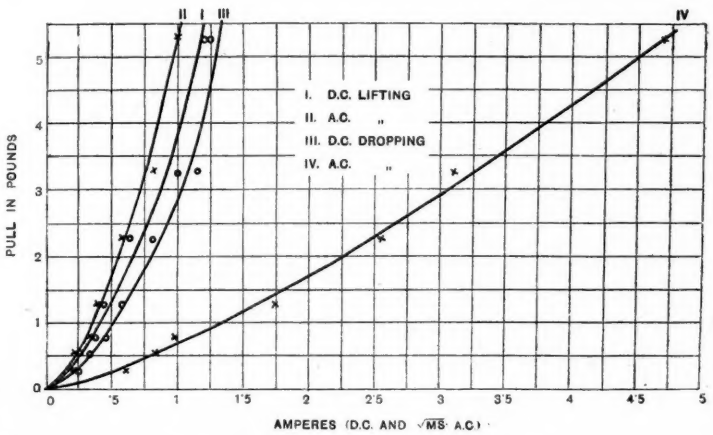

Fig. 3.—Pull Curves with 0·01-in. Air Gap.

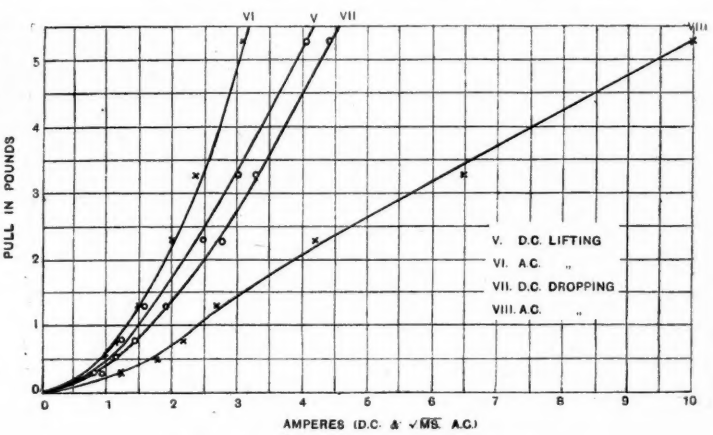

Fig. 4.—Pull Curves with 0·04-in. Air Gap.

a given small change of air-gap length; and (4) the frequency.

If, on the other hand, the armature is separated from the poles by fixed, non-magnetic, distance pieces (or is tight up against the poles), and the problem is to determine at what current the armature will be released, the effect of using A.C. will be the reverse of the above, *i.e.*, the pull on A.C. will be *less* than on D.C., with the same current values. For now, during the periods of excess pull (x to y, fig. 1), the armature cannot approach the poles and reduce the air-gap L, because of the distance pieces, but during the intervals of low pull (y to z, fig. 1) the armature is free to move away, so that the net effect over the whole period is to give an effective air-gap with A.C. somewhat *greater* than the fixed air-gap L, with D.C.

In order to investigate this difference between D.C. and A.C. electromagnets, some experiments were recently carried out at the West Ham Municipal Technical Institute (chiefly by Messrs. W. J. E. Ball and W. A. Wordley, engineering students) on magnets of various types and sizes.

In the case of plain solenoids pulling on straight, laminated iron cores, no measurable difference between the pull with D.C. and the pull with A.C. of the same $\sqrt{M\,S}$ value could be detected with either short or long coils. This is probably because in such cases a small change in the position of the iron core has very little effect on the pull—the effective air-gap, and consequently the flux, being hardly altered at all.

When, however, magnets of the more usual type, having a practically all-iron magnetic circuit and a comparatively small air-gap, were tested, a marked difference between the pulls on D.C. and A.C. was obtained.

Some typical results, as obtained on a small laminated horseshoe electromagnet, are given below.

of various lengths from ·01 in. to ·187 in., and (*b*) when the armature was kept off the poles by distance-pieces of various thicknesses, was held tight against these distance-pieces by switching on a comparatively strong current, and was then allowed to *drop* off by gradually reducing this current. The results are given in tabular form below, and in the form of curves in figs. 3, 4 and 5.

Length of air-gap at each pole in inches.	Total weight of armature and load in lb.	Test (*a*). Amperes required to lift armature.		Test (*b*). Amperes at which armature drops off.	
		D.C.	$\sqrt{\text{M.S.}}$ A.C.	D.C.	$\sqrt{\text{M.S.}}$ A.C.
·01 in.	·283	·22	·21	·26	·61
	·533	·26	·23	·37	·83
	·783	·38	·35	·455	·98
	1·283	·425	·4	·59	1·75
	2·283	·61	·585	·81	2·55
	3·283	1	·83	1·15	3·1
	5·283	1·2	1	1·22	4·7
·04 in.	·283	·81	·75	·94	1·24
	·533	1·05	·98	1·12	1·75
	·783	1·21	1·17	1·41	2·18
	1·283	1·55	1·5	1·92	2·7
	2·283	2·48	2	2·75	4·2
	3·283	3·0	2·37	3·28	6·5
	5·283	4·07	3·07	4·4	10
·187 in.	·283	3·75	3·7	3·85	4·25
	·533	5·1	4·9	5·2	5·9
	·783	5·95	5·4	6·35	7·8
	1·283	7·8	6·9	8·5	10·2
	2·283	11·3	10·6	—	—

The slight differences between the D.C. for "lifting" and for "dropping" with the same load and air-gap, are probably

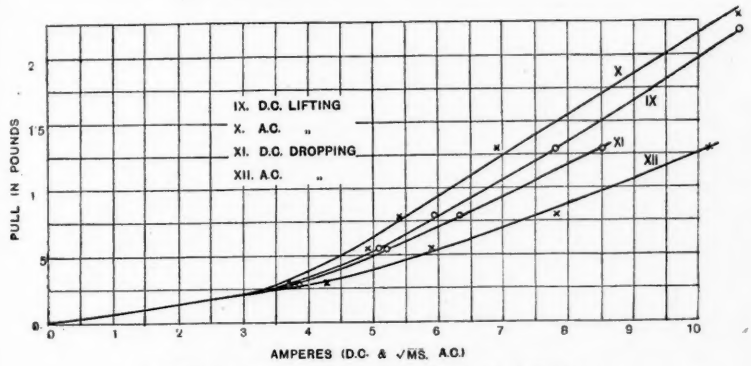

Fig. 5.—Pull Curves with 0·187-in. Air Gap.

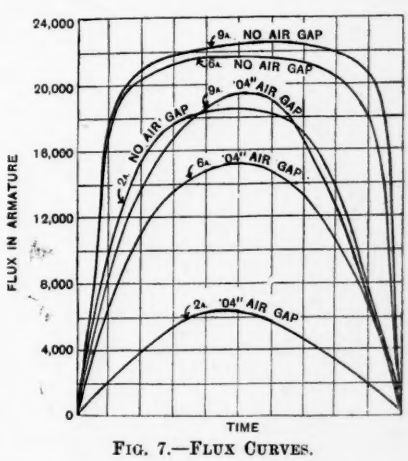

Fig. 7.—Flux Curves.

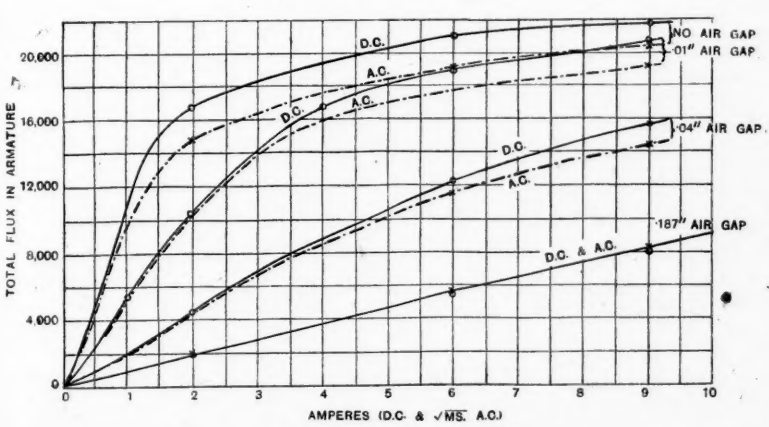

Fig. 6.—Flux Curves, D.C. and $\sqrt{M\,S}$ A.C.

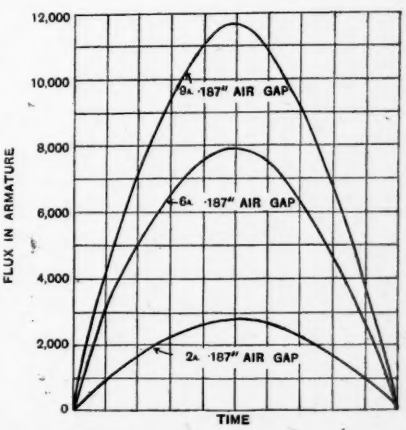

Fig. 8.—Flux Curves.

The dimensions and arrangements of this magnet are shown in fig. 2. The weight of the armature and scale pan was ·283 lb., and additional weights up to 5 lb. were placed in the pan. Sets of readings were taken to find the connection between the weight and the current with D.C. and A.C. (*a*) when the magnet was used to *lift* the load across air-gaps due to the difficulty of avoiding slight tilting of the armature just before "lifting," as compared with the definite fixed-air gap ensured by the distance pieces used in the "dropping" tests. For the same reason no very great accuracy can be claimed for the absolute pulls recorded, especially with the smaller air-gaps.

In order to make sure that the effect of iron saturation was negligible within the range of the above tests, a set of flux measurements was made on the magnet by means of a ballistic galvanometer connected to a few exploring turns wound round the centre of the armature, the throw of the galvanometer being noted on reversing various direct currents with various air-gap lengths. In this way the full-line curves of fig. 6 were obtained. These show clearly that, within the range of amperes used in the above tests, the flux keeps well below the knee of the curve for all the air-gaps. Consequently, the distortion of the time curve of flux, as compared with the time curve of current with A.C., should be very slight. This is fully confirmed by some determinations of the actual $\sqrt{M S}$ values of the A.C. fluxes (shown as the dotted curves in fig. 6). These alternating flux values were obtained by first recording the shapes of the alternating-current curves by means of an oscillograph (as shown in fig. 9 for various currents and air-gaps*), and

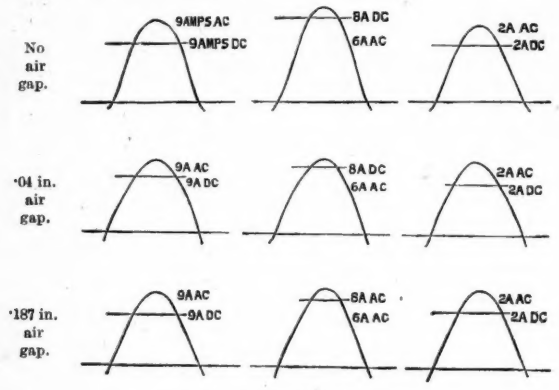

Fig. 9.—Current Curves.

then, from these oscillograph records and the D.C. flux curves in fig. 6, plotting out the corresponding time curves of flux (as shown in figs. 7 and 8), on the assumption of constancy of air-gap length. The $\sqrt{M S}$ values of these flux curves are then readily found.

By doing this for a number of currents with each air-gap, enough points connecting $\sqrt{M S}$ amperes with $\sqrt{M S}$ fluxes were obtained to enable the dotted curves in fig. 6 to be plotted. This procedure was considered preferable to obtaining the shape of the time curves of flux direct by oscillograph, as can be done, for instance, in the way described by Messrs. Morris and Catterson-Smith in a paper read before the I.E.E. in 1904 (*Journal*, Vol. 33, p. 1020), by connecting an exploring coil on the magnet armature to a choking coil of negligible resistance, and obtaining the curve of the current sent into this choking coil by means of an oscillograph. This curve will be substantially of the same shape as the magnet flux curve. This method was, in fact, used in a number of cases (the armature being unloaded and the air-gap, therefore, constant) and gave flux curves practically identical with those obtained indirectly from the current curves, as described above. At the higher saturations, however, owing to the extremely rapid rise of the flux curve from zero, the oscillograph used was no longer able to follow the curve correctly.

The closeness with which the A.C. (dotted) flux curves agree with the D.C. (full-line) flux curves in fig. 6, within the range of the pull experiments, *i.e.*, up to fluxes of 9,000 or 10,000, shows that the pull curves in figs. 3, 4 and 5 may be safely considered as being uninfluenced by iron saturation, and that the differences between the D.C. and A.C. pulls for the same currents are solely due to differences between the D.C. fluxes and the $\sqrt{M S}$ A.C. fluxes produced by the periodic variation of the air-gap on A.C., as described above.

In conclusion, it will be useful to summarise the results by putting down the ratios of the D.C. pulls to the A.C. pulls for this particular magnet, as read off the curves in figs 3, 4 and 5 for certain currents. Thus, with an air-gap of ·01in., and a magnetising current of 1 ampere, the ratio : $\frac{\text{D.C. pull}}{\text{A.C. pull}}$ is about ·69 when *lifting* and 4·3 when *dropping*.

With a ·04-in. air-gap and 3 amperes, the ratio is ·71 when *lifting* and 2·1 when *dropping*. With an air-gap of ·187 in. and 8 amperes, the ratio is ·88 when *lifting* and 1·35 when *dropping*. It will be seen that the difference between the A.C. and D.C. pulls gets steadily less as the air-gap length increases, owing to the diminishing percentage effect of a given fluctuation in air-gap length.

A greater difference between the D.C. and A.C. pulls is found in the *dropping* tests than in the *lifting* tests, probably due to the fact that, in the lifting tests, the possible momentary *reduction* in air-gap is limited by the length of air-gap under test, whilst in the *dropping* tests, the possible momentary *increase* in air-gap was not artificially limited in any way—the adjusting screws being set well back.

It may be mentioned that, in the above tests, a 105-volt 50-cycle A.C. supply was used, although the magnet itself only required from 5 to 15 volts. The large excess of voltage was taken up in a non-inductive resistance, and consequently, when once the current had been adjusted, its value was practically unaffected by any fluctuations of air-gap due to armature vibration. The case is, therefore, not quite identical with that of an alternating electromagnet fed from a constant-voltage source without regulating resistance.

Similar tests carried out on a larger laminated horse-shoe magnet, capable of exerting a pull of from 100 to 200 lb., gave results in every way confirmatory of the above-described tests on the small magnet.

* The scale of these oscillograph curves is given by the D.C. line marked on each.

THE NEW ELECTRICITY IN MINES RULES.

(*Continued from page* 376.)

In regard to the construction of apparatus for high-pressure plant, the Committee point out that "High pressure tends towards the use of less cumbersome apparatus and cables, and generally in the direction of superior construction, for whereas medium-pressure apparatus can generally be got to work *however poor its condition*, risk of shock and risk of open sparking being ignored, high-pressure apparatus must be *kept in good order*, or it cannot be got to work at all." It must not, however, be inferred from this that it is *always* better to adopt a high-pressure system, as naturally this will greatly depend upon the character of the mine, and it should be remembered that the efficiency of the system depends upon the insulation resistance, which becomes more difficult to maintain as the pressure is increased.

Next in importance to reliable switchgear, &c., is the cable system, which "if improperly protected or installed," is even "a greater source of danger than any other part of an electrical installation." The Report continues : "There are two methods of avoiding danger ; (*a*) so to protect and enclose the cables that any fault is *confined to the inside* of a metallic covering, or (*b*) to endeavour to keep the cables apart from each other and from earth. The first principle means the enclosure of the cables in a very substantial metallic covering or pipe ; the second means separate cables supported on insulators." Probably no part of an electrical installation has been more discussed or has given rise to more diversity of opinion amongst mining engineers than has this question of cable protection, but under the new rules the controversy "Armoured *versus* Unarmoured Cables" is settled once and for all in favour of the former. Very reasonable arguments are put forward in favour of both, and probably as many accidents have occurred with the one as the other. With plain insulated cables the danger lies in the insulating covering being cut or pierced, so that the live wire is bared ; whilst with armoured cables the danger is that the armouring may be driven into the insulating material so that it comes in contact with the inside live wire, and so makes the whole of the armouring alive. Two fatal accidents taken from the list previously mentioned illustrate the type of accident. In the first, deceased was pushing a tub when it

"left the rails and struck a cable, cutting through the insulation to the live wire"; in the second, "Deceased . . . whilst walking out-bye . . . . touched a broken signal wire, one end of which was in contact with a damaged armoured cable, the armouring of which was live." The peculiarity about these two accidents is that had the cable been armoured in the first case and unarmoured in the second, neither accident would have occurred. It is also evident, however, that had the armouring been efficiently earthed in the second case, the man could not have received a shock, and here is just where the trouble comes in. Can the armouring be *efficiently earthed*, and *kept so* throughout the system? Instead of armouring the cables, it has been suggested to run the cables in strong wooden boxes, but in one case where this was done a man inadvertently drove a nail through the cover and insulating material until it came in contact with the live wire. This, however, may be looked upon as a most exceptional type of accident, and should scarcely be cited as an argument against wood casing, which can be made strong enough to resist any damage due to the usual mine accidents such as fall of stone or runaway tubs. It should, of course, be laid on the floor of the mine, and there are only two possible objections to its use, one that of fire, which is very remote; and the other, that it is not particularly suitable for wet roadways. But in mining something is wanted against which *no* objections can be lodged, and in view of the experience with armoured cables, even when attempts have been carefully made efficiently to earth the armouring, it cannot be said that armoured cables are absolutely safe, as so very much depends upon the efficient earthing being *constantly maintained*.

At a colliery in the North of England the cables are laid in strong earthenware troughs filled in solid with bitumen, the troughs being laid on the floor of the roadway close to the side. This would seem to be an excellent method to adopt, as it no doubt would give a sufficiently strong mechanical protection, and is free from the objections as regards damp and fire, and even if the earthenware trough did get broken, it seems almost impossible that any metallic substance could come in contact with the live wire, so as to become dangerous to touch. It would, at any rate, be interesting to know whether under the new rules H.M. District Inspectors of Mines would be justified in passing such a system of installing main cables, or could accept it as satisfactory. Probably the very best system is to place the cables in cast-iron troughs, filled in solid with bitumen, and to place these on the floor, or if there is much water, to support them on iron brackets fixed close to the side, and as near to the floor of the roadway as possible. This method fulfils all the conditions laid down by the new rules, which state:—(Rule 12 Sub-Secs. (*b*) (*c*) and (*e*) "All cables shall be efficiently protected from mechanical damage, and supported . . . . in such a manner as adequately to prevent danger and damage to the cables." "Concentric cables, or two-core or multi-core cables protected by a *metallic covering* shall in all cases be used," and "the metallic covering of every cable shall be (1) electrically continuous throughout; (2) earthed at the surface of the mine by a connection to the earthing system of *not less conductivity* than the same length of the said metallic covering; (3) efficiently protected against corrosion where necessary; (4) of a conductivity at all parts and at all joints at least *equal to 50 per cent.* of the conductivity of the *largest* conductor enclosed by the said metallic covering." There is no doubt that cast-iron casing or troughing would be less liable to be attacked by corrosion than iron or steel armouring, though there might be some little difficulty in obtaining continuous electrical conductivity at the joints without resorting to some form of "bonding." On the other hand, each section could be connected to an earth wire which would run throughout the system, and be connected to earth plates at the surface.

Though the Report contains references to "armoured" cables, there is nothing in the rules which *enforces* armouring of cables. In fact, from Rule 12 Sub.-Sec. (*d*), it is clear that single-core *unarmoured* cables are permitted provided that the pressure does not exceed "low" pressure, and "they . . . . be properly secured by some non-conducting and readily breakable material to efficient insulators," otherwise, "single-core cables shall be *enclosed* in a metallic covering, which shall contain *all* the conductors of the circuit." Above "low" pressure, however, *all* cables *must* be protected by a metallic covering.

(*To be concluded.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment No letter can be published unless we have the writer's name and address in our possession.*

Live-Steam Feed-Water Heating.

May I add a small contribution to the discussion upon this matter. An illustration, which I have used on several occasions, to show how, as it appears to me, the introduction of cold feed water into the boiler, affects its efficiency, and per contra, the introduction of hot feed water, favourably affects its efficiency, is the following:—

The ideal boiler, as I understand the matter, would consist of a single thin copper plate, on the upper side of which a continuous stream of water would be flowing, means being taken to carry off the steam as it is formed. On the other side there would be a continuous stream of hot gases, flowing in the opposite direction to that of the water. Assuming such an ideal to have been arranged; suppose that the stream of water is interrupted by some obstruction, having a high thermal resistance. The efficiency of the arrangement, as it appears to me, would be considerably reduced. The reduction of efficiency would be roughly in proportion to the extent of the obstruction, and to its thermal resistance. By whatever distance the stream of water was forced out of its natural path, and by whatever amount the thermal conductivity at that point was reduced, by the same amount, roughly, would the efficiency of the arrangement be reduced.

The introduction of cold, or comparatively cold feed water into the boiler, in my view, is equivalent to the placing of such an obstruction in the path of the water in the ideal arrangement sketched above; and the more nearly the feed water can be heated to the temperature of that already in the boiler, and the more nearly it can be directed into the boiler without creating eddies or changing the flow of the circulation, the more nearly does the practical boiler approach the ideal.

Sydney F. Walker.

Bath, *March 10th*, 1911.

Price Cutting.

The cutting of prices, particularly in electrical manufacturing works, arises from two main causes. Either it is due to ignorance or to grab.

If the first be the cause, the ignorance is usually due to a lack of appreciation of the total costs of manufacture.

If the second be the acting cause, this is due to a sort of panic, a fear lest orders should slip by, and so different works cut one against the other in place of tendering at reasonable prices, when all would take the orders they were best fitted by peculiar location and circumstances to carry out.

But there is, perhaps, a special and peculiar reason why electrical works have been price cutting. All of them have come into being during recent years. There is no tradition handed down from former days of individual ownership. In the case of old-established works it is not so many years since they were all owned by individuals with the fear of the court of bankruptcy always before them, and filled with a determination to return a dividend to the ordinary shareholder. If the ordinary shareholder received no dividend, the managing director went hungry, for he owned all the shares and was, therefore, anxious to do more than pay salaries, pay interest on loans, or keep square with the bank. He wanted to pay dividends. In the case of the modern limited liability company many managing directors and their colleagues seem to be concerned only

to pay debenture interest and salaries. Trifles like preference shares do not count; the ordinary shareholder is merely a man whose duty it is to find the capital and build the works on which the debenture-holder advances working capital to pay salaries. This is the position in a nutshell, and price cutting is simply due to the Limited Liability Act as used by men who have behind them no tradition of individual business responsibility to keep them straight, for it is not possible to describe as straight this denial of the ordinary shareholder. Initial over-capitalisation may be urged as a reason, but this usually is a misnomer, for over-capitalisation usually implies excessive promotion profits, and it is not then possible to make a reasonably fair profit on the shares. But no matter how much over-capitalised, there should always be some profit left for ordinary shares if the management is right.

B.

Commercial Engineering.

With reference to your leading article on "Commercial Engineering," commenting upon Mr. Railing's address to the Engineering Society of the Birmingham Municipal Technical School, you say on page 374 of your last issue, "We think it was hardly fair of him to introduce so much contentious matter into a lecture delivered to students, upon 'Commercial Engineering,' and to give so one-sided a view of the arguments." I should like to draw your attention to the fact that the membership of the Engineering Society is open to all past and present teachers and students of the School, and that the lecture was therefore not delivered merely to students, but to men who had had considerable practical experience in actual engineering work.

Personally, I do not see any unfairness in Mr. Railing giving his views on the influence of the tariff system on the commercial side of engineering. As politics do not dominate the members, they are perfectly willing to listen to both sides of a question and form their own opinions.

It is clearly evident that your critic has only one view, and does not give the opposite aspect of the case a passing thought.

T. H. Essery,
Hon. Secretary, Birmingham Municipal Technical School Engineering Society.

Birmingham, *March 11th*, 1911.

Insulating Materials.

We have been greatly interested in the very able paper read by Messrs. Fleming and Johnson on "Chemical Action in the Windings of High-Voltage Machines," and also your editorial comments thereon.

We were particularly pleased to note that the authors of the paper confirm a point that we have endeavoured to impress upon our friends in the electrical industry for many years past; the point being that the less cement of any kind used with mica, the better is the insulation obtained, and that wherever practicable no cement whatever should be used.

Referring to the following quotation from your editorial remarks, "excessive vibration tends to cause a mechanical disintegration of *mica* insulation"; should this not read *micanite*—or built-up mica—insulation? We do not think that any amount of vibration—within reason—would disintegrate a piece of pure mica, although this would doubtless happen to an artificial material, made up from small flakes of mica, and a binding cement. Too frequently we fear that mica is blamed for faults with which it has nothing whatever to do.

Many firms do not seem to realise the supreme importance of having the best insulation obtainable for their machines. What is the value of the finest dynamo in the world if its insulation is defective or uncertain? And yet to save a few pounds on a machine costing, perhaps thousands, the price of its insulation is cut down until it is impossible to obtain a first-class article. It is the old cry of "Spoiling the ship for a ha'porth of tar." Surely such a policy is very short-sighted.

Mica, we venture to suggest, meets all the requirements of an insulator mentioned in your last paragraph. It is non-hygroscopic, it has high dielectric strength, great tensile strength, and will stand an enormous temperature without alteration.

The question of the best insulation is of the greatest importance to the electrical industry. Could not you, Sirs, as Editors of the leading electrical paper, undertake to conduct a thorough investigation of the problem? This requires handling by an impartial authority to obtain really satisfactory and reliable results. If an electrical firm conducts the investigation, it is hardly reasonable to expect them to publish their results for the benefit of rival firms; whilst if a manufacturer of insulating materials inquires into the subject, he is certain to be under the suspicion of favouring his own specialities.

If you could see your way to conduct this investigation, it would be a great and notable service to the industry. We should be only too pleased to aid the good work, by giving you all the assistance within our power, so far as mica is concerned, and we do not doubt but that other manufacturers of insulating materials would extend to you equal facilities.

The whole subject of insulation is of such importance—particularly owing to the rapidly increasing use of high-voltage machinery—that we hope you will throw open your "Correspondence" columns and invite a full discussion of the whole problem.

F. Wiggins & Sons.

London, E., *March 14th*, 1911.

[Our columns are open for discussion of this exceedingly important subject, about which so little definite and reliable information is available. The National Physical Laboratory, which is a perfectly impartial authority, has already done valuable work in this field, and we suggest that further researches might be carried out by it with great advantage to the electrical industry.—Eds. E.R.]

Breaking High and Low Potential Circuits.

In your report of the discussion on the above paper, in your issue of 3rd inst., you make me to say that: "Even if the whole energy of the circuit were taken by the *arc*, it was estimated that 17,000 kw. could be interrupted with a cubic foot of *air*."

Permit me to say that my contribution was to the effect that: "Even if the whole energy of the circuit were taken by the *oil*, it was estimated that 17,000 kw. could be interrupted with one cubic foot of *oil*."

No doubt you have not realised that my proposal is *to do away with* the arc, as far as practicable, and to convert the energy of the circuit into heat, in the oil, at any distance from the arc that we please, by dissipating the heat in thin strip resistances immersed in the oil.

By this arrangement the arc, which is further reduced by being broken up into some 20 small portions (separate from each other), is quenched in cool oil, the strips being several inches away from the elements of the arc.

A. M. Taylor.

King's Heath, *March 11th*, 1911.

[We regret the errors quoted; our report was printed as received from a local correspondent.—Eds. E.R.]

Cheap Units.

Whilst electricity undertakings are showing such remarkably cheap costs of production as they are at the present time, very little attention seems to be given to the fact that the average price obtained per unit is also descending very rapidly; yet the policy of selling cheap units is still being advocated up and down the country, and the lighting consumers, who are the mainstay of the whole undertaking, are passed over and neglected. This catering for cheap units, unfortunately, pays in the beginning, but must eventually lead to disaster.

To illustrate my meaning, let us, for an example, take an undertaking with an output of 6,000,000 units, lighting and traction :—

Total costs to equal	'42d.	'8
Capital charges	'38d.	
Average price obtained...	1·2d.	

Now imagine the above undertaking to have obtained an additional load of 3,000,000 units per annum at an average price of ·45d., and by producing these additional units the costs are reduced thus—

Total costs to equal	'39d.	'75.
Capital charges	'36d.	

Average price obtained then becomes ·95d.

Let us now examine the financial result of our deal, and we find that from a profit of—

6,000,000 at '4d. = 2,400,000d.
to 9,000,000 at '2d. = 1,800,000d.

600,000d.

or a loss of £2,500 on the deal.

This cannot, surely, be a policy which it is good to continue. The figures are, I think, considerably better than a great many undertakings which are burdened with obsolete plant can ever hope to obtain.

H. P. M.

[Our correspondent's figures seem more hypothetical than practical. What undertaking is selling one-third of its output at 0·45d. a unit, with works costs at 0·39d. ?—EDS. E.R.]

"INQUIRER," Calcutta.—The name and address of the writer have not been received.

LEGAL.

CONNOLLY BROS., LTD.

IN the debenture-holders' action in *re* Connolly Bros., Ltd., Wood *v.* The Company, application was made to Mr. Justice Parker, in the Chancery Division on February 24th, for the appointment of a receiver and manager of the defendant company.

The plaintiff, a debenture-holder, moved on the ground of jeopardy, the company confessing that it had not the money to pay the current wages. The motion was opposed by the Liverpool Mortgage Insurance Co. and John William Davidson, as trustees of the debenture deed, on the ground that in the exercise of their powers, they had already appointed a receiver. It transpired, however, that the first debenture trust deed contained no powers for appointing a receiver, and the powers the trustees purported to have exercised, were contained in the deed securing the second debenture issue, of which the Insurance Co. and Davidson were also trustees.

His LORDSHIP, after considerable discussion, appointed Mr. John MacDonald Henderson, with directions, to find the money for paying current wages.

On Friday, March 8th, MR. MARK ROMER, K.C. (with him Mr. Sarjeant), on behalf of the plaintiff, moved to restrain Mr. John Joseph O'Reilly from further proceeding with an action in the County Palatine Court of Lancaster, an action in which Connolly Bros., the Liverpool Mortgage Insurance Co. and Mr. J. W. Davidson were defendants.

COUNSEL reminded his Lordship that on February 24th he appointed a receiver at the instance of the plaintiff as representing the first debenture-holders of all the assets of the company. The debentures were issued in the year 1901, and were secured by a trust deed of which the Liverpool Mortgage Insurance Co. and Mr. John William Davidson were trustees. Besides property specifically mortgaged there was a general floating charge on the rest of the assets of the company. There were the usual provisions that the company were not to create any charge to rank in priority or *pari passu* to the debentures, but it appeared that in the year 1904 one Mary O'Reilly advanced certain moneys to the company and took from the company as security the deposit of the title deeds of certain property which the company had recently acquired. That property was not the property of the company at the time the debentures were issued, but was, he submitted, included in the floating charge. The trusts of the deed having become inforcible, the plaintiff issued the ordinary debenture-holders' writ for the purpose, enforcing the debentures and carrying the trusts of the deed into effect. The defendants to that action were Connolly Bros., Mr. George Rathbone, as representing the second debenture-holders, and the trustees of the debenture deed, the Liverpool Mortgage Insurance Co., and Mr. John Davidson, who were also trustees of a deed to secure the second debentures. At that time the plaintiffs were unaware of Mr. John Joseph O'Reilly, who had become the holder of the mortgage given to Mary O'Reilly. Mr. O'Reilly, however, seemed to have known of the plaintiffs' action, and it would be interesting to know how, and from where, he got the information. From the fact that he did know, and also from the fact that no interest had been paid on his mortgage since 1907 without any protest on his part, it looked as if he was connected in some way with the company, and at all events was a friend at court. At any rate, it appeared to have occurred to him that he might, by taking proceedings in the County Palatine Court, obtain the appointment of a receiver over the assets that were specifically mortgaged to him. On February 21st without any communication to the plaintiffs in the debenture-holders' action, he issued his writ in the County Palatine Court asking for the appointment of a receiver. To that action he made the company and the trustees for the debenture-holders defendants, and on February 22nd on an *ex parte* application he obtained the appointment of a receiver over the following Monday, February 27th. The property over which the receiver was appointed contained machinery which though not in actual use might be required for the company's business. On February 27th, notwithstanding that it was pointed out to the Vice-Chancellor that a receiver had been appointed in this action, be re-appointed the receiver that had already been appointed for a short time. The plaintiffs thereupon obtained leave to make Mr. O'Reilly a defendant to the debenture-holders' action in order that the question of priority might be thrashed out, and moved to stop the Palatine proceedings on the ground of the great inconvenience of having two receivers over the same property, and the expense of having two actions running to which the debenture trustees were parties.

MR. GRANT, K.C., for O'Reilly, was willing that the question of priority should be determined in the Palatine Court.

MR. ROMER objected.

MR. GRANT submitted that this Court had no jurisdiction to stay the proceedings in the Palatine Court.

His LORDSHIP said it might be a serious contempt of Court to have obtained the appointment of a receiver in the Palatine Court after he had appointed a receiver, but he did not want to say anything about that if the parties were willing to go to the Palatine Court and get the proceedings there stayed.

MR. GRANT said he was not willing to do that, and his Lordship reserved judgment.

[The judgment was delivered on Wednesday, and appears in our "Notes."]

THE LONDON ELECTRIC SUPPLY CORPORATION, LTD., *v.* THE WESTMINSTER ELECTRIC SUPPLY CORPORATION, LTD.

(Continued from page 381.)

ON Wednesday, March 8th, MR. GORE-BROWNE, replying for the defence, said that if the contention set up by the defendants obtained, the moment a company got a provisional order they could make arrangements with someone else entirely outside the order, and give them the rights they had got under the order. Why should a company which obtained a provisional order be limited to its exercise within its own area, when a person without an order could make arrangements within any area? Up to 1908 there could not have been any doubt on this matter, because the words of the Act were: "shall not associate themselves with any other company or persons supplying energy . . . unless authorised by Parliament." Statutory powers never could be delegated, except by authority. In this case it must be observed that the agreement provided that the plaintiffs should distribute the energy, and that the defendants should act merely as managers. Were the defendants to be allowed to destroy the goodwill of the plaintiffs' business, and with it the plaintiffs' income? Yet they were doing all this, as they said, in the interests of the plaintiffs; and this in spite of the fact that the Act provided for the "mutual assistance or association" of the companies.

His Lordship reserved judgment.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Experimental Vertical-Shaft Motor.

A novel type of motor has been made by the J.-L. MANUFACTURING CO., LTD., of Johnson-Lundell Works, Southall, to the requirements of Mr. R. D. Archibald, for laboratory experimental work at the new Technical Institute, Dundee.

The machine (fig. 1) is a four-pole D.C. variable-speed motor, designed for a continuous output of 10 B.H.P. on 400 volts at 300-1,000 R.P.M. It stands on a heavy cast-iron circular bed-plate, and is arranged vertically, with pulley on the under side (fig. 2), to render commutator, brush gear and all connections easily accessible.

The base is a casting in the form of a truncated cone, supporting the field yoke and poles on a ball race, which takes both weight and side stresses. The field and poles, therefore, which are both laminated, are free to rotate, but are fitted with a torque measuring device, consisting of a spring balance connected to the field-frame by a steel cord. This cord lies in a groove, so that its centre is at a radius of 1·05 ft. from the centre line of the machine, this measurement being equal to $33/10\pi$ ft., and thus facilitating calculation of the H.P. The armature revolves on ball bearings round a steel centre post or shaft, firmly secured to the bed-plate of the machine.

A search coil is provided in the armature, connected to the terminal board through slip-rings and brushes, to enable investigations of the field form to be made either with an oscillograph or by plotting a curve from instantaneous readings. The latter are

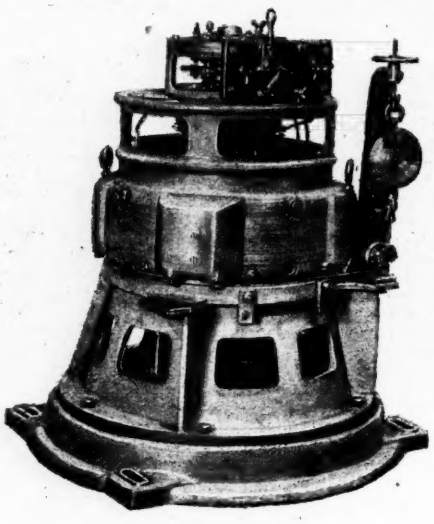

Fig. 1.—J.-L. Vertical-Shaft Motor.

obtainable by means of a contact-maker and variable timing arrangement, by which the time of contact and also the position of the coil at time of contact are variable through the whole range required.

The motor is compound wound, and is fitted with interpoles, all connections being brought separately to the terminal board.

Fig. 2.—Armature of Motor.

Different thicknesses and qualities of carbon brushes are provided, so that the effect on commutation of various combinations of field connections and brushes can be observed very readily. The machine

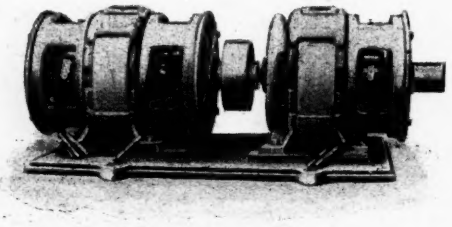

Fig. 3.—J.-L. Motor-Generator.

can be easily dismantled in all parts, the brush gear and connections being specially accessible. The efficiency when running as a motor with a load of 10 B.H.P. at 300 R.P.M. is 86 per cent.

The firm's principal manufactures are motors of the Lundell type with laminated fields, which have a very high efficiency with lessened weight; machines on this principle, with ball bearings and flexible couplings, lend themselves admirably for use as motor-generators such as that shown in fig. 3, which, being provided with slip rings, gives either D.C. or A.C. for demonstration purposes, and a variety of such combinations has been made by the firm for technical colleges, bioscope shows, &c.

The laminated field construction also lends itself to experimental investigations on single-phase motors.

The "Paller" A.C. Paralleling Voltmeter.

Although great improvements have been made in apparatus for paralleling alternators, and the rotary synchroniser has practically superseded synchronising lamps, the operation must always involve two components—both phase and pressure regulation, and the latter usually requires the observation of two separate volt-meters. In D.C. work the central-zero voltmeter has long afforded the solution of the second difficulty, but A.C. stations have hitherto held to the more primitive system, the difficulties in the way of a similar A.C. central-zero voltmeter being very considerable.

Messrs. Everett, Edgcumbe & Co., Ltd., of Collindale Works, Hendon, N.W., believe that the "Paller," illustrated in fig. 4, is in fact the first practical instrument of the kind; it is provided with terminals for the bus-bar connection and the incoming machine respectively, and equality of pressure is shown by the pointer standing at zero in the middle of the scale. The scale is marked

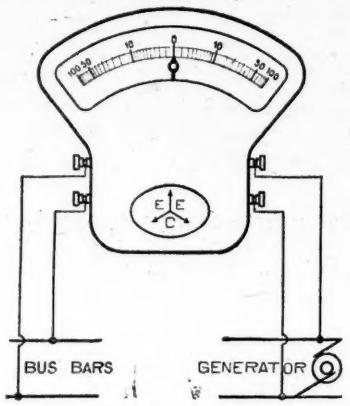

Fig. 4.—The "Paller" A.C. Paralleling Voltmeter.

"Too high" on one side and "Too low" on the other, corresponding to the voltage of the incoming machine. The instrument shown is wound for 100 volts, for connection to the secondaries of step-down pressure transformers. The extreme openness of the scale on either side of the central zero is noteworthy; in the case of a moving-coil instrument for continuous current, this opening-out of the scale is only possible by means of an auxiliary spring or some such comparatively complicated method, whereas in the present instrument it is a fundamental feature of the design. The deviation from zero can thus be read from a distance.

Arrangements can be made for the "Paller" to actuate an audible or visual signal when the voltage is right, so that the attendant need only watch the synchroniser while paralleling.

The instrument is made in various patterns, and can be made portable, for plugging in where desired, if necessary.

"Handshield" Fuseboards.

The British Central Electrical Co., of 84, Hatton Garden, E.C., who have made a speciality of apparatus complying with the Home Office Regulations for Factories and Workshops, have now brought out a type of shielded fuse in accordance with the Regula-

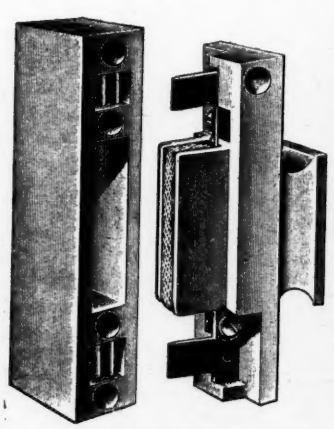

Fig. 5.—"Handshield" Fuse.

Fig. 6.—"Handshield" Fuseboard.

tions. The illustration, fig. 5, shows clearly how the fuse is completely shielded, so that the user, replacing it, say, on an overload, is protected from contact with live metal, and from the flame of the arc in the event of its being blown. Fig. 6 shows a distribution board fitted with six of these fuses.

"Clair" Automatic Wrench.

A patent automatic wrench for both tubes and nuts has been introduced by Messrs. J. C. Lyell & Co., Ltd., 113, Great Portland Street, W.; it is claimed that it is impossible for it to slip.

Simplex Fire Extinguisher.

Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, have recently introduced a new fire extinguisher for putting out electrical and petrol fires. The liquid which forms the extinguisher is a non-conductor and has no detrimental effect upon the cables; it puts out a fire arising from short circuit, in addition to preventing it from spreading.

Fig. 7.—Simplex Extinguisher for Electrical Fires.

The extinguisher is built of steel and tested to 250 lb. per sq. in.; it is operated by compressed CO_2 carried in the small auxiliary vessel at the side, and will send a jet some 40 ft.

The CO_2 gas is sufficient to empty the extinguisher of liquid three times, and the CO_2 reservoir can be recharged in 10 minutes for 1s. A variety of satisfactory tests have been carried out with the extinguisher at the City of Birmingham Municipal Technical School.

Live-Steam Feed-water Heater.

The accompanying illustration, fig. 8, shows a device for which provisional protection has been obtained by Mr. Vernon Smith, of 67, Station Road, Finchley, N.; it is an internal live-steam feed water heater, and serves at the same time to some extent as a purifier. The feed water, entering by way of the feed pipe FP, passes through a perforated tee-piece, and comes in contact with a dash-plate; the water then showers into a conveyor tray T, to which are

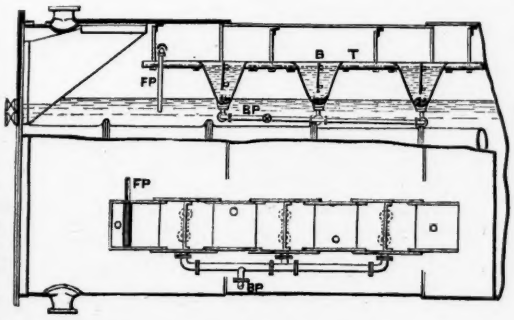

Fig. 8.—Internal Live-Steam Feed Heater (Plan Inset).

attached three or more pockets, which have division plates B fitted to them. As the whole apparatus is slightly inclined, the water, by gravitation, finds its own way through the various pockets and over the end of the tray into the main body of water in the boiler. With a boiler working at 100 lb. pressure and using feed water at 60° F., the temperature of the water flowing over the end of the tray would be from 200° to 250° F. The impurities which are deposited in the heater are blown off through the pipes BP, which are connected to the bottom of the pockets of the heater, and the blow-off valve on the front of the boiler.

"Home Office" Accessories.

In one of Messrs. Veritys' new publications they place before the electrical trade and contractors, and whoever else may be interested in electrical illumination preparations for the approaching Coronation, illustrations of a number of their "Fairyland" devices —trophies, stars, crowns, reflector letters, monograms, weather-proof transparencies, &c. The Aston "Fairyland" illumination strip material, with and without reflectors, is particularised, and prices are given. In connection with the appearance of their No. 617 publication, to which we refer under "Catalogues and Lists" to-day, we select for illustration one or two lines which are of more interest than the rest, and which are specially designed to meet the requirements of the Home Office Regulations for Factories and Workshops. Fig. 9 shows the "H.O." totally protected lampholder (a registered design), which consists of the interior and sleeve portion only of their knife-contact double-action holder (A 2,940), which is totally enclosed in a boxwood

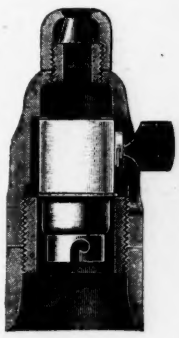

Fig. 9.

Fig. 10.

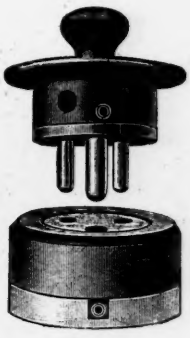

Fig. 11.

ebonised cover, and has a large cord grip. The usual metal case of the ordinary lampholder, as will be seen, has been dispensed with. One of the firm's earthing terminal lampholders, made to meet the same regulations, appears in fig. 10, while in fig. 11 we show their two-pin type (shockproof) "Handshield" shoe and plug. This list also contains many other lines of interest for factory installation work, including ironclad switches, high-voltage cut-outs, distribution fuseboards, and many lines for lighting installations in all classes of buildings.

Ironclad Distributing Panel.

The accompanying illustration shows a new three-way distributing power panel for collieries and workshops, on the built-up system adopted by Messrs. Berry, Skinner & Co., of 78, Upper Thames Street, E.C. The three ways enter by way of the central chamber, with the ammeter in series with one of them. They are

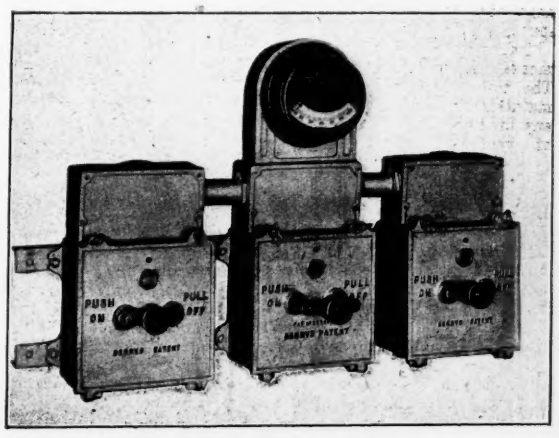

Fig. 12.—Three-way Ironclad Distributing Panel.

connected to three distributing terminal blocks in each inspection chamber, from which the three-pole switches control the respective motors. No live parts are accessible, and the gear is claimed to be entirely foolproof.

Evershed's Moving-Coil Cell Tester.

Messrs. Evershed & Vignoles, Ltd., of Acton Lane Works, Chiswick, are supplying a cell tester of the moving-coil type, which takes about ·005 ampere as working current; it is fitted with patented spring pivots which stand a great deal of knocking about. The instrument is very light, the case being of aluminium, and it can even be dropped without necessarily hurting it, although this treatment is not recommended by the makers. The spikes are designed, as shown in the figures overleaf, so as to make the testing of cells as simple and easy as possible; the barbs are double-ended, and can be either pushed against, or hooked on to the terminals, while they are well insulated except at the ends.

The battery record block and aluminium holder is a simple attachment which enables all notes and entries to be made without using any support other than the instrument itself; those who are accustomed to test accumulators will appreciate what this means. The block contains a sufficient number of blank forms for a year's weekly records to be made.

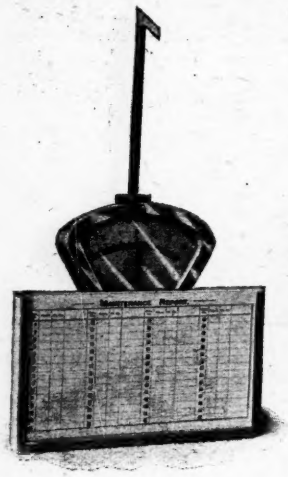

Fig. 13.—Cell Tester with Record Block Attached.

Fig. 14.—Eversheds Cell Tester.

These instruments have been sent journeys on motor-bicycles, and have returned in perfect working order.

ELECTRIC FIRELESS COOKERS.

The Hartford Electric Light Co. has developed an electric cooker with which a family of from three to five persons can be provided for at a minimum cost of 1½d. per KW.-hour, corresponding to a continuous consumption of 150 watts at a flat rate of 12s. 6d. per month. Any consumption at this rate lasting less than 24 hours per day is of corresponding benefit to the central station, which can sell electrical energy profitably for 24-hour service on a large scale at even ¾d. per unit.

About a dozen cookers have been built since June, and the company has now reached a point where arrangements are being negotiated for the manufacture of the device on a commercial scale.

Two sizes of cooker have resulted from the company's experiments, one being rated at 100 watts, and the other at 50 watts. The tests have shown that 100 watts input will continuously maintain a temperature of 380° F., which is sufficient for roasting any kind of meat or baking any kind of bread. The present type of oven, designed to meet the needs of a family of four persons, consists of a box of fibrous material, 19 in. wide, 17½ in. high, and 18 in. deep, outside dimensions, containing two disk heating elements 6½ in. in diameter, located at the top and bottom of an interior oven lined with glazed white fireclay, and surrounded by asbestos or other suitable insulating packing. The interior oven is 12½ in. long, 8 in. high, and 10½ in. wide, and has a capacity of two loaves of bread at once, set in appropriate baking pans. Each heating element is made up by the company in its laboratory, and the resistance coil consists in each 50-watt unit of approximately 60 in. of Driver-Harris No. 33 nichrome wire. The wire is pressed mechanically against a fireite plate in a recess ¼ in. deep, the total thickness of the plate being ½ in. The plates are countersunk to a depth of ¼ in. into the top and bottom of the fireclay oven, and the two plates in the 100-watt cooker are electrically connected in parallel. The cooker is provided with a hinged cover with insulating material of the same kind as that used in the body of the cooker, and straps are provided with a harness clip on each, these locking the cover securely in position, and preventing the escape of any noticeable amount of heat. The locked cover is not so tight, however, that steam cannot escape when liquids are boiled in the oven. The present cookers used by the company are designed to operate on a 60-volt circuit, which is used in the residences which the company supplies with tungsten lighting on a flat rate; but operation on higher voltages has been provided for.

The 50-watt cooker is cylindrical in shape, its outside diameter being 14 in., and the depth of the oven about 9 in. It consists of a 50-watt heating element of the type used in the larger cooker, set into a glazed white stone jar 8 in. in diameter, which is surrounded with heat insulation, with an outside fibrous covering, and a top cover of the plunger type with felt washer, asbestos and fibre insulation. The top cover is 2 in. thick, and is countersunk into the jar to permit retention of heat. In each type of cooker the fireite plate containing the heating element is sealed into the oven by retort cement. Current is supplied in each case through a flexible cord connection leading into the interior through a brass bushing in the side of the cooker near the bottom. The low power consumption of each cooker enables it to be plugged on any ordinary lamp socket without difficulty of any kind. From the first the effort has been made to produce a cooker which would be compact, portable and thoroughly sanitary. The heating element has been immersed in hot water without deterioration of the insulation. In general, the larger cooker is planned for baking, roasting and other relatively short-time service, the smaller outfit being used for stewing, boiling and other long-hour service. The company's rate for service for both cookers, used as many hours of the day and night as the consumer requires, is to be 12s. 6d. per month for families of three to five people. The main object which the company has in mind is the popularisation of electricity for cooking, with resultant increase in revenue from energy sales.

Tests which the company has made are given below:—

Roast lamb, 4¾ lb.	100 watts	...	1 hr. 45 min.
Meat pie	100 watts	...	1 hr. 15 min.
Marble cake	100 watts	...	1 hr.
Tomato sauce	100 watts	...	15 min.
Mashed turnips and potatoes ...	50 watts	...	3 hrs.

Eight persons served.

Tests show that 250° can easily be maintained by the 50-watt cooker.

Ham, baked beans, cereals, corned beef, meat stews, &c., are usually put in the cooker at 8.30 p.m. and left all night. At 7 a.m. they are taken out, well done. Sponge cake can be baked in about 1 hr. in the 100-watt cooker.

On account of the small amount of power required to handle the work without substantial expense for energy, it is necessary to allow a somewhat liberal time for cooking the various articles. Hence good planning in the use of the time brings its reward, and the preparation of foods requiring a shorter time to cook while the longer-cooking foods are in the oven reduces the amount of labour materially.—*Electrical World.*

BUSINESS NOTES.

New Zealand.—The New Zealand Customs authorities have recently given a decision to the effect that "electric appliances, cut-outs, automatic for dynamos, if imported attached to dynamos" are to be classified under No. 183 of the Tariff, the duty on foreign productions being 15 per cent. *ad valorem*, and on British goods 10 per cent. If the cut-outs are imported separately they come under the classification of No. 190, the duty then being 30 per cent. and 20 per cent. *ad valorem* respectively.

Mirrlees-Diesel Oil Engines.—The following is a list of some of the orders for these engines recently executed or at present in hand and in course of construction in the works of Messrs. Mirrlees, Bickerton & Day, Ltd., of Hazel Grove, near Stockport:—

One of 100 B.H.P., for Hazel Grove Rubber Co., Ltd., Stockport; one of 50 B.H.P., for Bognor Electricity Works; one of 375 B.H.P. and one of 500 B.H.P., for L.B. & S.C. Ry. Co.; two of 150 B.H.P., for Sale U.D.C.; one of 250 B.H.P., for Edmundson's Electricity Corporation, Ltd., for Guernsey; two of 85 B.H.P., for Admiralty; three of 80 B.H.P., for War Office: one of 200 B.H.P., for Bulgaria; two of 45 B.H.P., for Imperial Japanese Navy; one of 40 B.H.P., for Caledonia Sugar Estates, Penang; one of 50 B.H.P., for Kuala Lumpur Engineering Co.; one of 375 B.H.P., for Manekji Petit Mill, Bombay; one of 500 B.H.P., for Diesel Engine Co., Ltd.; two of 150 B.H.P., for New Zealand; one of 150 B.H.P., for Windsor Electricity Works (per the Diesel Engine Co.); one of 200 B.H.P., for New Zealand; three of 115 B.H.P., for Namaqua Copper Co., South Africa; three of 92 B.H.P., for Santiago Nitrate Co., Chile; two of 200 B.H.P. and one of 132 B.H.P., for Canada; three of 200 B.H.P., for Madeira Lighting and Power Co. (per the G.E. Co., Ltd., London); two of 200 B.H.P., for Barbadoes Electric Supply Corporation (per Messrs. Hooghwinkel, Anthony Brown & Partners); one of 150 B.H.P., for Vulcan Motor and Engineering Co., Southport; one of 100 B.H.P. for Bohemia.

China.—The U.S. Consul at Amoy, in a very entertaining report on the modern cities of Interior China, says that Taiyuanfu, the capital of Shansi Province, with a population of 60,000, has broad well-paved streets, electric lights, telephones, modern school and college buildings, &c. Until there are means of transportation there cannot be much improvement in the foreign trade opportunities in West China, but railways leading to important points are being constructed, and in a few years a most profitable market should be opened up for foreign machinery. In Chengtu, the capital of Szechuan, and possibly in Sianfu, the capital of Shensi, important public works may be inaugurated during the next five or ten years. "These cities will undoubtedly soon be installing electric lighting plants and purchasing machinery for industrial factories of various descriptions."

Australia.—The building boom in New South Wales and the increasing favour with which the landowners view "sky-scrapers" should make good opportunities for electric lifts and all electrical requirements usual in such premises.

Austrian Cable Syndicate.—The arrangements existing between the makers of cables in Austria, only refer to lead-covered cables. The negotiations in respect of the constitution of a syndicate for insulated conductors, have been broken off owing to the excessive demands made by individual works.

Book Notices.—*The Universal Electrical Directory, 1911.* London: H. Alabaster, Gatehouse & Co. Price 14s. 6d.—This publication has now reached its thirtieth annual appearance, and once again it bears evidence of the zeal of its compilers in their efforts to make it what the trade requires. In compliance with requests received from many quarters, one section of the general alphabetical division is devoted exclusively to London, including all names and addresses that are likely to be of service to those doing business with electrical engineers and traders within a radius of 15 miles from Charing Cross. All other addresses in the kingdom are given in the remainder of the alphabetical division. The

usual British classified section follows, also that ever-useful feature, the British geographical section. In the colonial and general divisions—both alphabetical and classified—is found a list of addresses which are indispensable to all electrical firms and others doing business with other countries. Once again we would draw attention to the list of electricity works in this section, where the kind of supply, and its pressure, periodicity, capacity, &c., are given. Continental and American sections bring up to the rear. We wonder whether users ever stop to think how large an undertaking the production and correction of such a directory is, with its vast host of names and addresses in all parts of the world. We believe that when once they fully appreciated the difficulties, they would say even nicer things than they do already! As editors of the ELECTRICAL REVIEW, we are constantly receiving evidence that far fewer firms than ought to be are supplied with an electrical directory. The number of queries given to us through the post and over the telephone in the course of the year, in the answering of which we have resort to the "Red Book," is very large, and convinces us that there are many firms who, if they really knew the nature and completeness of its contents, would hail "The Universal" as a boon.

"Elementary Aeronautics." By Albert P. Thurston. London: Whittaker & Co. Price 3s. 6d. net.

"Electric Wiring Diagrams." By W. Perren Maycock. 1911. London: Whittaker & Co. Price 2s. 6d. net.

"Prospectus of the Working Men's College, Inc., Melbourne." 1911. Melbourne: The College.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXVII, Part 1. February, 1911. London: Andrew Reid & Co., Ltd.

"Revue d'Electricité." Vol. XXVII, No. 1. January, 1911. Brussels: Emile Bruylant. Price 1.75 fr.

"*Journal* of the American Society of Mechanical Engineers." Vol. 33, No. 3, March, 1911. New York: The Society.

Knowledge for March contains an article on "X-rays," by Dr. Reginald Morton, describing various uses of the rays, including the examination of electric cables.

Dissolutions and Liquidations.—CONNOLLY BROS., LTD., Blackley Vale, Manchester.—Proceedings in connection with the appointment of a receiver are reported in our "Legal" columns to-day.

THORIUM (METAL-FILAMENT) LAMP WORKS, LTD.—Mr. J. C. Gardner (Chalmers, Wade & Co.), 24, Coleman Street, E.C., has been appointed liquidator of this company.

BRITISH ELECTRICAL DEVICE CO., LTD.—A meeting is called for York Buildings, Adelphi, W.C., on April 19th, to hear an account of the winding-up from the liquidator, Mr. P. J. Boucher.

ARC LAMPS, LTD.—A petition for winding up this company, presented by Siemens Bros. Dynamo Works, Ltd., is to be heard on March 21st.

Bankruptcy Proceedings.—ISIDOR FROHWEIN.—A sitting of the London Bankruptcy Court was held on Thursday last week before Mr. Registrar Hope, for the public examination of Isidor Frohwein, who applied to pass upon accounts showing liabilities £441 (unsecured £411), and assets "nil." The examination was concluded.

J. A. BAUER, electrical engineer, 17, Gracechurch Street, E.C.—March 29th is the last day for receipt of proofs for intended dividend by Mr. G. E. Corfield, 19, Finsbury Pavement, E.C.

Trade Announcements.—THE ELECTRIC & ORDNANCE ACCESSORIES CO., LTD., have appointed Mr. Arthur W. Wingate, Gisburn, Clitheroe, as their sole agent for the sale of "Duralumin" in Lancashire, Yorkshire, Westmoreland and Cumberland. The company are now able to supply "Duralumin" in bars, wire, sheets, strips, solid-drawn tubes, angles, tees, channels, sectional metal, drop stampings, forgings, &c.

THE "CEDES" ELECTRIC TRACTION, LTD., are removing to larger offices at 112, Great Portland Street, London, W., on March 25th.

TRACKLESS TROLLEY, LTD., are removing on March 25th to 112, Great Portland Street, London, W.

Mr. A. E. Watts, representative of MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., Manchester, notifies that he has removed to 17, Merrion View Avenue, Sydney Parade, Dublin.

MESSRS. GEO. HILL & CO., LTD., of the Trafford Electric Works, Cornbrook, Manchester, are giving up the manufacturing portion of their business.

MR. J. HAMER, electrical engineer, of 10, Broad Street, Halifax, announces that he is relinquishing the manufacturing department of his business.

THE MAXIM LAMP WORKS, LTD., have removed to Maxim Works, Canonbury Road, Highbury, London, N.

Catalogues and Lists.—THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., Trafford Park.—Illustrated brochure of 50 odd pages, dealing with the firm's small horizontal gas engines which are being manufactured at Trafford Park, and are now being placed on the market. That the Westinghouse Co. have made large gas engines for many years our readers do not need telling, but in the present list they show gas engines of from 2 B.H.P. to 33 B.H.P., which they are now making, with the benefit of their experience in large sizes to guide them. The pamphlet is made more interesting by the inclusion of a number of clear half-tone photographic views of the works, the departments shown being the chemical laboratory, the foundry, the machine and erecting shop, store room, &c. The gas engines are described and shown both in complete form and in pieces. Gas producer plants for operation with anthracite and with bituminous coal are included. Copies of this catalogue will be forwarded to any reader interested, on receipt of a note of his business address.

ALLEGEMEINE ELEKTRICITATS-GESELLSCHAFT, Berlin.—Catalogue of searchlight projectors and accessories associated therewith, including iris diaphragms up to 600 mm. diameter, signalling shutters, Zeiss mirrors, lenses, &c. Various devices for the mechanical and electrical control of projectors from a distance are included, and particulars of dimensions and weights are given.

MR. A. E. INGLE, 13, Albert Place, Manchester.—Leaflet describing a patent earthing clip for conduits, cables, pipes, &c.

THE CREDENDA CONDUITS CO., Chester Street, Birmingham.—Those of our readers who desire to show their loyalty by flying the Union Jack at Coronation time should secure one of this company's priced leaflets of steel conduit poles which are supplied for such a purpose, enamelled or galvanised.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—16-page price list (No. 275) in the firm's standard form and size, giving illustrations, tabulated prices and other information relating to "Mazda" holophane glassware. Representative types of these reflectors are shown for all average conditions. A series of galleries, in which there are no screws or other loose parts, is included in the list.

MR. GEORGE ELLISON, 17 and 18, Warstone Lane, Birmingham.—Illustrated sheets have been issued as follows: No. 186, describing and giving prices of totally enclosed oil-immersed "Star-Delta" starters for squirrel-cage three-phase motors for up to 650 volts; No. 217, similarly dealing with totally-enclosed A.C. circuit-breakers of the triple-pole "Mill" type with overload and no-volt releases, up to 650 volts.

MESSRS. E. BENNIS & CO., LTD., Little Hulton, Bolton.—Pamphlet containing an illustrated description of a new CO_2 recorder that the firm are now placing on the market.

THE CRYPTO ELECTRICAL CO., 149-159, Bermondsey Street, London, S.E.—24-page catalogue giving a full description (including specifications of petrol engine and dynamo), with illustrations, tables of prices, &c., of their electric light plants for large or small country houses.

THE WALSALL ELECTRICAL CO., LTD., 57, Bridge Street, Walsall.—Illustrated and priced leaflet describing the Walsall battery auto cut-in and cut-out, in which a number of improvements are embodied. Copies of the circular on application.

MESSRS. VERITYS, LTD., 31, King Street, Covent Garden, and Birmingham.—New catalogues:—No. 617 (48-pp.) illustrating and giving prices of a variety of electrical accessories; No. 618 (52-pp.) detailing new electrical bells and bell material, and giving a large number of small illustrations of these manufactures, together with notes of their prices; also a 12-page publication relating to their "Aston" electrical illuminations for the Coronation. We refer to some of the lines in these lists in "New Devices" to-day.

Staff Ball.—The staff of MESSRS. BRUCE PEEBLES AND CO., LTD., held a successful ball recently in the North British Station Hotel, Edinburgh, over 150 being present. Mrs. Lee Murray (wife of the general manager of the company) acted as hostess for the committee, and received the guests in the ballroom. Dancing commenced about 9 o'clock, and after the eighth dance a halt was called to allow of the inner man being refreshed, during which interesting operation the seat of honour was occupied by the general manager. After the toast of "The King," Mr. W. A. Scott (works manager of the company) proposed "The Firm," which was responded to by Mr. F. E. Andrews and Mr. A. W. Tait (directors of the company). The toast of "Our Guests" was proposed by Mr. A. B. Anderson and replied to by Mr. James Watt. After supper dancing was resumed.

A Business League.—We read in the *Ironmonger* that an organisation known as the Business League has been founded to promote the formation of a business Government with business men in control, and to secure the appointment of a Minister of Commerce independent of Government changes. It also proposes to bring about the entire rearrangement of the Diplomatic and Consular Service, the holding of an Imperial conference for the purpose of bringing about a commercial union of Free Trade within the Empire, or failing this a preferential basis as against foreign State-aided competition, and the introduction of regulations whereby, when British loans are raised for foreign enterprises involving the purchase of manufactures, it should be a condition that such manufactures are obtained in England. The chairman is Mr. Frank Dudley Docker, of Birmingham.

Electric Welding Plant for Russia.—A firm in Russia invites firms in this country to send particulars, prices and time of delivery of electric welding apparatus (with generator and switchgear) for welding 54,000 chain rings per shift of 10 hours—27,000 rings of 4 mm. wire, and 27,000 of 5·8 mm. wire. Weights and sizes must be sent, to calculate the duty payable, and drawings are asked for. We will forward the address to manufacturers on application.

Lists Wanted for Australia.—Mr. P. J. Pringle, general manager and chief engineer of the Electric Supply Co. of Victoria, Ltd., Wendouree Parade, Ballarat, Victoria, Australia, advises us that as they are now starting showrooms and canvassers with a view to energetically pushing power, lighting and heating, he will be pleased to receive the latest lists from manufacturers of such apparatus in this country.

Tantalum Traction Lamps.—We are informed that a batch of tantalum lamps installed on a tramcar has run 11,870 miles with only one breakage—and that a broken bulb, not a broken filament. The lamps, we believe, are still running.

France.—An international syndicate of producers of ferro-silicon by electrical methods has just been formed, with headquarters in Paris.

LIGHTING and POWER NOTES.

Aberdeen.—The Corporation Electricity Committee's recommendation that an arrangement be entered into with the Great North of Scotland Railway Co. for a supply of current for lighting, heating and power, for five years, has been approved of by the T.C. The rate is to be 2½d. per unit for the first year and 2d. per unit for the remaining four years. The company undertakes to consume or pay for 135,000 units during the first year, 140,000 units during the second year, 150,000 during the third year and 160,000 units during each of the fourth and fifth years. The supply is to be for the company's own use, in its stations, workshops, offices and hotels, the joint passenger station and the Caledonian Railway goods yard.

Acton.—At Monday night's meeting of the Electricity Committee, the accountant reported that the deficiency on the working of the undertaking for the past year was £1,363, as compared with £675 for 1909-10. During the latter period £10,822 was received from the sale of electricity, but last year, and it was the first time the amount had receded since the undertaking was started, the income from this source went down to £10,582.

The London and North-Western Railway Co. have asked for a supply of electricity to all their stations, sidings, signals, signal boxes and other premises in the Acton area. Mr. J. Martin Blair (engineer) said the company had informed him that their present consumption of gas was about 5,000,000 cb. ft. per annum, and they desired to know whether the Council were prepared to enter into an agreement with them for the supply of current at a special tariff. The cost of the extensions to cables necessary to give a supply would be about £485. He had, at the request of the chairman, sent a copy of the letter to the Metropolitan Electric Supply Co., Ltd., and on its behalf Mr. Highfield suggested that in view of the negotiations taking place, with a view to the transfer of the Acton undertaking to the Metropolitan Electric Supply Co., the railway company should be asked to allow the matter to remain in abeyance. This the Committee agreed to.

Altrincham.—The U.D.C. has recommended the Lighting Committee to have all lamps on the tramway route affixed to the tramway standards, and to consider the question of lighting the lamps by electricity instead of gas.

Argentina.—A company has been organised at Sao Paulo, known as the Companhia de Electricidade de Corumba, with a capital of 335,000 milreis, for the purpose of furnishing electric light and power to the city of Corumba, in the State of Matto Grosso.—*Commercial Intelligence.*

Atherton.—A L.G.B. inquiry will be held on the 23rd inst. into the D.C.'s application to borrow £5,000 for the purposes of its electricity undertaking. During the past year there has been an increase in the demand for current of over 100 per cent.

Barnstaple.—A L.G.B. inquiry was held on March 7th into the application of the T.C. for a loan of £1,970 for E.L. purposes. Included in the sum was £1,077 money overspent beyond loans. The Inspector (Mr. H. R. Hooper) pointed out that the excess expenditure went back to the beginning of 1907, and asked why the Council had not applied to the L.G.B. for power to borrow the money before. It was replied that the amount would have been a small one, and as future extensions were contemplated, it was thought advisable to make one application. Mr. Hooper also criticised the charge for public lighting, 4½d. per unit, and said it was about the highest in the country. There was no opposition.

Bexley.—It is estimated that the electricity and tramway undertakings will show a gross profit for the year ending March 31st next, of £6,914, and that there will be a net surplus of £174.

Blackpool.—The lighting of the promenade came in for criticism at the Town Council meeting on the 7th inst. In reply to Councillor Bean, who pointed out that the lamps were now useless, it was stated that the Committee was waiting for the introduction of a new and improved electric arc lamp, when the old lamps on the front would be replaced.

Burton-on-Trent.—At a meeting of the T.C., Ald. T. E. Lowe presented the report of the Electricity and Gas Committee, showing that the sales of electricity for light, heat and motors had increased by 58 per cent. during the past year, while the fuel consumed had been practically the same.

Continental Notes.—Sweden.—H.M. Consul at Stockholm reports that during the year 1910 there was a considerable increase in the use of Swedish water power. Twenty-one new water power stations were finished ready for use. One of these is State property, namely, that at Trollhättan, where, up to the present, 40,000 H.P. has been actually developed; the other 20 are private property, and represent 63,530 H.P., including Stora Kopparbergs Bullerforsen station, with about 24,000 H.P., and two stations erected by the Sydsvenska Kraftaktiebolaget with about 10,000 H.P. Five water-power stations also were re-built during 1910, giving 7,650 H.P., so that the total supply of hydro-electrical energy introduced into Sweden during 1910 amounts to 111,180 H.P.

According to the *Svensk Export*, there are at present under construction stations which should produce an additional 115,000 H.P. Of this amount, 50,000 H.P. is accounted for by the State station at Porjus, and the other 65,000 H.P. by seven private water power plants.

The development of water power in the neighbourhood of Umeä has not been realised to the extent that was expected, and local complaints explain the delay as arising from somewhat severe State conditions. The development is, however, almost sure to take place sooner or later, and H.M. Consul suggests that British firms taking an interest in the matter should apply for further information to the British Vice-Consul at Umeä.—*Board of Trade Journal.*

Dewsbury.—The T.C. has decided to reduce the charge for current for private lighting at Ravensthorpe from 4½d. to 4d. per unit from next July. For power and heating the present charges of 2½d. for the first hour and 1d. beyond, have been reduced to 2½d. and ½d.; and the charges for current taken between 9 p.m. and dusk from September 15th to March 31st (current being available at any time during summer), have been reduced to ¾d. per unit for a consumption of up to 20,000 units per annum; ⅝d. per unit for between 20,000 and 50,000; $\frac{9}{16}$d. for between 50,000 and 100,000; and ½d. beyond.

Dover.—The T.C. has reduced the price of current for cooking and heating where E.L. is used in the house, from 2½d. per unit to 2d. for the first 100 units, and 1d. beyond; meters are to be charged for at 1s. per quarter.

Elland.—The U.D.C. has decided to ascertain upon what terms the Yorkshire Power Co. will supply current in bulk delivered at the electricity station and transformed to meet the requirements of the Council.

Golborne.—The B. of T. having inquired what steps are being taken to carry out the Electric Lighting Order, 1906, the U.D.C. has replied that it is not at present in a position to form any definite scheme, but it would like to preserve the order. The Council has received an offer of energy in bulk delivered on premises adjoining the Council offices, at 2d. per unit.

Greasborough.—The U.D.C. has decided to consent to energy being supplied by the Rotherham T.C. to the Home Office testing station being erected in the Council's district, and within the area of the Yorkshire Electric Power Co.

Hastings.—The T.C. has decided to have the electric light installed at the Borough Sanatorium at a cost of £189.

Heckmondwike.—The Council is to supply energy for illumination purposes in connection with the Coronation at 3d. per unit.

Hessle.—The B. of T. has informed the U.D.C. that the consideration of the revocation of the E.L. order has been deferred for six months, to give the Council an opportunity of carrying out a scheme of electric lighting.

Heywood.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £355, being additional expenditure required in connection with the extension at the electricity works.

Hornsey.—The Electricity Committee in its estimates for the year ended March 31st, 1912, puts the income at £21,792, an increase of £2,077, and the estimated surplus at £1,902, as against £1,855 for the 12 months ended March 31st, 1911. In regard to the last-mentioned sum, the previous balance was £1,189. A new item in the account is £250 for proposed alterations to the condensing plant. Mr. Parkyn asked what was the cost of the mains laid which did not return a revenue of 20 per cent. on the outlay. Alderman Wilson said it was not possible to arrive at even an estimate of the figure without an enormous amount of time and labour, but it was clear that a large proportion of mains did not produce 20 per cent. in revenue, because the average percentage on the whole system was barely 25 per cent. The percentage had gradually risen from 15 per cent. in 1904.

Liverpool.—The Mersey Docks and Harbour Board had before it a recommendation to provide six electric delivery cranes at the north end of the shed on the east side of Toxteth Dock, at a cost of £1,900.

London.—Holborn.—At the meeting of the B.C. on March 8th, the Works and General Purposes Committee reported that, on considering its report of January 26th last, on the subject of the improvement in the public lighting of the borough, which was referred back by the Council on February 8th for that purpose, it has come to the conclusion that the proper course for the Committee to take is to recommend that fresh tenders be invited from the Gas Light and Coke Co., and the Metropolitan Electric Supply Co., Ltd. (representing the electric lighting companies having powers of supply in the borough), upon a specification and tender form which the Committee had instructed the town clerk and borough surveyor to prepare and submit to the Council. The former tenders were in the form of a list of prices for individual lighting units of different magnitudes, and the total cost of carrying out any scheme depended upon the number of the different units required. It was impossible, therefore, to make anything but an approximate comparison between the two tenders until a definite decision had been arrived at as to the quantity of light which the Council would consider sufficient in each street. The Committee thought it advisable, as a preliminary step, to appoint a sub-Committee to settle a suitable scheme of lighting, and this sub-Committee had reported at the last meeting of the Council. The Committee went on to say that, when its former report was before the Council, doubts were expressed as to the advisability of the contract being made for such a long period as 10 years, and with a view of meeting

this objection, it now proposed that the term be five years, with an option to the Council to extend it for a further period of five years. Due provision is made in the specification that the contractors shall undertake at their own expense all required lengthening of existing columns, provision of new columns and lanterns, altering or extending services, mains, &c., and everything necessary for installing, lighting and maintaining the new system of lighting for an inclusive sum per annum. The contractors are also required to quote a separate scale price for any variations in the light that may afterwards be necessary. Finally, the Committee recommended that the schedule of public lighting for the borough drawn up by the Sub-committee be approved, and that the Metropolitan Electric Supply Co., Ltd., and the Gas Light and Coke Co. be invited to tender according to the specification and tender form now before the Council for carrying out the same.

On the adoption of the report being moved, Councillor Motion brought forward as an amendment that the Council was in favour of electric lighting for the whole of the borough, and that it be an instruction to the General Purposes Committee to obtain tenders for electric lighting based on the schedule placed before the Council at the last meeting. Subsequently Councillor Motion altered his amendment to the effect that the tender of the Metropolitan Electric Supply Co., Ltd., already received, offering to do the lighting for £6,700, be accepted. He said the suggestion that the gas company should be allowed to tender again was against the expressed wish of the general body of members of the Council as declared a month back. Referring to the instances, mentioned at the last meeting, of boroughs that had reverted from electric light to gas, Councillor Motion said he was in a position to challenge the statements made then by Councillor Angel. Bethnal Green had never had electric light, Lambeth had as much electric light as Holborn, Paddington had made no change in the last six years, Finsbury never had electric light, nor had Wandsworth.

Councillor Angel explained that at the last meeting he read from a report which he then understood was furnished by the borough surveyor. He now understood that it came from the chairman of the Works Committee and emanated from the gas company.

The Mayor said Councillor Motion ought to have given notice of motion.

Alderman C. E. Green moved an amendment accepting the Committee's recommendation in part, but suggesting that the term of contract should be for 10 years instead of five, the Council reserving power to terminate it at the end of the fifth or subsequent years. He pointed out that the five years' contract would give the gas company an advantage in tendering, as it would not have to find the capital outlay necessary if the other company did the work.

Alderman Green's amendment was carried by 19 votes to 13, and agreed to as a substantive motion.

Councillor Motion said that in spite of this, he should move at the next meeting that the contract of the Metropolitan Electric Supply Co., Ltd., to light the borough for £6,700 be accepted, and he gave formal notice of motion.

Newport (I. of W.).—By a majority of one vote only, the T.C. on March 8th decided to renew the contract for public lighting to the gas company for three years. The accepted price was £3 per annum per ordinary 100-C.P. lamp. The E.L. Co. tendered at £2 17s. 6d. per lamp per annum on a 10 years' contract, and this, some of the members contended, was the cheaper offer.

Runcorn.—The directors of the Salt Union, in their annual report, issued on March 10th, state that, as regards the electrical installation to be worked in conjunction with the vacuum plant at their works at Weston Point, a company is being formed by the Union to take over the provisional orders granted to Mr. Cox and Mr. Falk as its nominees. The initial capital will be found by the Union, but as the business develops and further capital is required, the shareholders will be afforded an opportunity of subscribing it. Negotiations with several large consumers of power have already commenced, and there are indications that the whole available supply will be absorbed within a comparatively short period.

St. Anne's-on-Sea.—The U.D.C. has decided to allocate £200 from the electricity profits to wipe off the debt on the Carnegie Library. There was some opposition to the proposal, but on the chairman of the Library Committee explaining that, unless the grant was forthcoming, the Library would have to be closed, it was decided to make the grant.

St. Helens.—The T.C. has decided that where electric decorative illuminations are installed by consumers for the Coronation, current will be supplied during the week at 1d. per unit.

Sandwich.—The East Kent Electric Power Co., which is to carry out an E.L. scheme for Walmer, Deal and Sandwich, has informed the T.C. that it intends erecting a generating station at Ash-next-Sandwich.

Shipley.—The U.D.C. has decided to extend the mains, at a cost of £200, in order to supply Messrs. G. Hodgson, Ltd., of Frizinghall, subject to a seven years' agreement.

Stoke-on-Trent.—The T.C. discussed for nearly four hours on Thursday, last week, the recommendation of the Electricity Supply Committee to expend £60,000 on a scheme for extending the present undertaking, by adding at the Hanley works plant on the three-phase E.H.T. alternating-current system, with sub-stations. The Committee recommended that the engineer (Mr. C. H. Yeaman) be instructed to prepare estimates and further particulars for the provision of new plant, consisting of two 1,500-KW. turbo-generating sets, together with the necessary boilers and accessories; further, that application be made to the L.G.B. for sanction to the borrowing of the sum of £60,000.

In a supplementary report on the proposal to link up the four existing works at Hanley, Stoke, Longton and Burslem, the engineer pointed out the necessity for a central generating station, remarking: "The four works cannot be linked up to assist one another, because there is no surplus power which would justify the expense of the links on this ground alone."

In the course of the discussion, it was stated that the new works could be got ready for the coming winter.

The Mayor and other members commented on the fact that under the Federation Act, the Corporation had to supply electricity at cost price and could make no profit out of it. Why, therefore, it was asked, should they run the risk of incurring that large expenditure? The Mayor understood that a company, of which Mr. Vesey Brown was the engineer, would shortly be in a position to supply electricity, and perhaps the Corporation could be supplied by that company until it was in a more prosperous condition as regarded the rates.

Ultimately, an amendment to defer consideration of the matter, "for the purpose of obtaining information whether the deficiency in the supply cannot be met by private enterprise" was defeated, and the Committee's recommendation was carried by 40 votes to 22.

Torquay.—During the Coronation celebrations, electricity for external decorative illuminations will be supplied free by the T.C.

Walsall.—Power users of direct current to the extent of not less than 30,000 units per annum are to be allowed in future to use current for lighting purposes at power rates up to an additional 10 per cent. of their power consumption. The Electricity Committee has approved of a plan submitted by the electrical engineer for distributing mains at Bloxwich. The total length of the mains is 2,782 yards, and the cost is put at £1,285. The work is to be carried out as soon as L.G.B. sanction has been obtained.

West Ham.—The borough engineer has submitted an estimate to the Highways and Parks Committee of £840 as the cost of lighting West Ham Lane and a portion of the Beckton Road recreation grounds with incandescent electric lamps. It is proposed by the Committee that this work should be carried out.

Weston-super-Mare.—The U.D.C. has invited the Electric Supply Co. to tender for street lighting for the whole or any part of the town in which its mains are laid, for a term of three years.

Wolverhampton.—£2,125 is to be transferred from the profits of the electricity undertaking for the year ending the 31st inst. to the credit of the improvement fund, and the sum of £2,125 is to be transferred from the profits of the tramways undertaking for the same period to the credit of the borough fund.

Woodbridge.—The U.D.C. has consented to meet Mr. Charrington, of London, and to hear his explanation of an E.L. scheme for the town.

TRAMWAY and RAILWAY NOTES.

Bolton.—The Tramways Committee has decided to double the whole of the track on the Tonge Moor and Bradshaw sections.

Bury.—A critical stage has been reached in the negotiations between the Corporation and its tramway employés. The tram conductors recently applied for a farthing an hour advance in wages, to bring them up to the standards of Rochdale and Wigan. The Corporation consented to the increase, but stipulated that there should be an agreement binding all grades not to seek any further advance for three years. These terms the men refused to accept, and neither side appears willing to give way. Ald. Jackson, the men's secretary, states that they had offered to submit the matter to arbitration, and that failing the acceptance of that offer by the Corporation, extreme measures would be taken.

Continental Notes. — HOLLAND.— Plans are under consideration by the local authorities and the tramway directors at Groningen for the reconstruction of the Groningen-Zuidlaren tramway and its extension to Annen, Eext, Grieten and Bareveld. It has been suggested that benzine-electric motors should be employed on the line. The cost of reconstruction and extension is estimated at about £37,000. It is expected that the project will be decided upon by April.

ITALY.—The Società Anomina per Ferrovie Vicinali has obtained a 70 years' concession for the construction and working of an electric light railway from Rome to Frosinone *viâ* Anticoli, with a branch to Frascati, Anticoli di Campagna and Guarcino. The total length of the line is 83 miles, and the cost of construction and rolling stock is estimated at £552,000.

A decree has been granted to Messrs. Andreucci-Allegra & Co. for a 50 years' concession for the construction and working of an electric tramway from Anzio to Nettuno. The total length of the line will be nearly two miles.

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France.—A novel electric tramway line has lately been completed in the grounds connected with the Institut Aeronautique de l'Université de Paris, at Saint-Cyr, near Versailles. The line is about seven-eights of a mile long, and on it runs a special electric truck designed to be fitted with different forms of planes for aeroplanes, in order to test the resistance of the planes at varying speeds through the air. A second truck intended for use in testing the efficiency of different forms of aeroplane propellers is also in course of construction.

Bradford.—The Tramways Committee has approved a report of the general manager with regard to the building of a new large central depôt estimated to cost £46,500, including lands.

Doncaster.—The Light Railway Commissioners have submitted to the B. of T. for confirmation an order authorising the T.C. to extend the tramways in the area for the R.D.C.

Ealing.—At the last meeting of the T.C. a letter was received from the Middlesex C.C., drawing attention to the bad state of the tramway track in the main road, Ealing, and stating that, unless the track was forthwith put into a proper state of repair, the County engineer and surveyor would be unable to certify under the Local Government Act, when the Council's accounts were sent in, that the road has been properly repaired and maintained. The matter was referred to the London United Tramways, Ltd. The Highways Committee recommended that the London United Tramways, Ltd., be notified that if the defects in the track were not remedied before the next meeting of the Highways Committee, the Council would have to consider the question of taking such steps under Sec. 28 of the Tramways Act, 1870, as would be necessary to put the track into a proper state of repair. This was agreed to.

Huddersfield.—Deputations from the Holmfirth and Netherthong U.D.C.'s have waited upon the Tramways Committee and again urged upon the latter the desirability of extending the tramways to Holmfirth, and eventually to Holmsbridge. The Committee placed certain proposals before the deputations, who promised to bring these before their respective Councils for consideration. The most important of the proposals was the indemnity to be paid in case the extension was not profitable.

Leith.—At a meeting of the T.C. it was agreed that the charge for electricity supply to the tramways be ·875d. per unit. It was remitted to the convener of the Electric Lighting Committee, along with the engineer, to consider the question of allowing a reduction in the price of electricity for illumination purposes at the Coronation. It was proposed that the Council should include in its first provisional order the extension of the tramway system to the boundary on the Seafield route. The directors of the Marine Gardens wrote regarding an extension to Portobello. A long discussion took place, and ultimately it was remitted to the Tramway Committee to report as to the extension of the system to the Seafield boundary. The Committee will also consider a proposal to extend the tramways from Duke Street *via* Easter Road to Pilrig Street.

London.—L.C.C.—The Highways Committee proposes to make a third extension of the central car repair depôt at Woolwich Road, so that it will be capable of dealing with 1,800 cars annually. The cost of the extension is estimated at £105,250 for buildings and £37,500 for tools, machinery, &c. The Finance Committee puts the total cost of the depôt at over £283,000, and the debt charges will amount to £16,400 for the first year, decreasing by £228 a year. The cost per car-mile, based on the estimated mileage when the whole system is electrified, corresponding to the first year's charge, would be about ·075d.

Manchester.—The B. of T. has appointed Sir David Harrell to act as arbitrator in the Manchester tramways dispute on the question of an eight hours' day.

Morley.—The extension of the Leeds city tramways to Morley is expected to be completed at the end of May. An agreement has been entered into between the Corporations of Leeds and Morley, whereby the Morley Council is to construct four miles of tramway in the borough, and on its completion to lease it to the Leeds Corporation for 30 years. Under the direction of Mr. Hamilton, the Leeds manager, the extension of the Leeds system into the Morley borough has already begun at the present Elland Road terminus, near Churwell.

Plymouth.—At a meeting of the Corporation Finance Committee, the sub-Committee appointed to consider and report as to the advisability or otherwise of insuring the Corporation against liability for accidents to workmen, and also against third party risks in connection with the tramway undertaking, recommended that no insurance should be effected, but that the sum of £1,000 should be included in the estimates of expenditure for the next financial year in respect of these liabilities, the amount to be apportioned in an equitable manner amongst the several committees concerned. The Committee was informed that during the period from August, 1907, up to the present time the sum of £386 8s. had been received from the insurance company in respect of claims for workmen's compensation and accidents in connection with the tramways; that during that time about £1,800 had been paid in premiums; and that it was estimated that if a fresh insurance were effected the annual premium in future would amount approximately to £1,000. The recommendation of the sub-Committee was approved.

Quarry Bank.—At last it has been definitely decided that the Quarry Bank Light Railway Order, which has been kept alive, so to speak, for several years, is to be taken over and operated by the company concerned in the Halesowen tramway scheme, so that there is now a reasonable hope of tramway communication being shortly established between Brierley Hill, Quarry Bank and Cradley Heath. This decision was arrived at on Wednesday in last week, the company treated with being Messrs. Balfour, Beatty and Co., and the deputation from the Joint Light Railway Committee consisting of representatives of the three Councils concerned. It is proposed now to construct a tramway between Brierley Hill and Cradley Heath, *via* Quarry Bank, the effect of which will be to link Quarry Bank with the rest of the Black Country tramway system. At present, the residents of that town are faced with a 20 minutes' walk to Brierley Hill, or one of 15 minutes to Cradley Heath. In addition to the benefit the new travelling facilities will give to Quarry Bank, a distinct advantage is also anticipated by the tradespeople of the other towns mentioned.

St. Helens.—The T.C. has been informed that the petition of the New St. Helens and District Tramways Co. against the Bill of the Corporation has been withdrawn.

Scarborough.—Another move in the aggressive attitude of the T.C. towards the Scarborough Electric Tramways Co., which, as our readers will recall, is in difficulties, and last autumn suspended service for the winter, was made on Monday night, when the Streets and Buildings Committee (consisting of all members of the Council) passed the following resolution:—"That the town clerk be instructed to inform the B. of T., in reply to their letter of March 7th, 1911, that the Committee see no reason for further deferring action upon the application of the Corporation under Secs. 41 and 42 of the Tramways Act, 1902; that the borough engineer be instructed to write to the tramways company asking them to carry out the necessary repairs to the track, and stating that if such request is not complied with, the Corporation will carry out the work and charge the same to the company."

The Corporation is awaiting the reply of the B. of T. to its application to determine the powers of the tramway company.

During discussion on the Hackney Carriage Committee's minutes at the T.C. meeting on Monday night, a member remarked that he understood another company was proposing to purchase the tramways, and "if they did they would run trackless trams or motor-omnibuses."

Torquay.—At the last meeting of the T.C. a letter was received from the Torquay Tramways Co., Ltd., relative to the company's commencing the construction of the Torquay and Paignton tramways. No objection is to be raised to the proposals of the company, subject to its submitting plans of the electrical equipment.

A trial car was run on Monday over the tramways which have recently been converted to the overhead system on the Forest Road section, from St. Marychurch Town Hall to Torre Railway Station, and everything worked satisfactorily. Traffic over the whole of the lines commenced later in the week. The cost of the conversion of the 11 miles of tramways from the surface-contact to the overhead system has been between £10,000 and £11,000.

TELEGRAPH and TELEPHONE NOTES.

Cable Breakdown.—The cable between Stornoway and the mainland has been interrupted since February 27th, but the wireless stations at Lochboisdale and Tobermory have maintained communication with the Long Island.

Mercadier System.—The multiplex telegraph system of Mercadier depends upon the transmission of signals by currents of differing frequencies upon a single circuit, the respective signals being sorted out at the receiving end by suitably resonant apparatus. Successful experiments were made in 1907 and 1908 with heavy metallic circuits, the Hughes apparatus being operated thus between Paris and Havre and Marseilles. Later the inventors, Messrs. Mercadier and Maguna, succeeded in working between Paris and Lyons on a single ordinary telegraph wire with earth return, three A.C. and one D.C. Hughes apparatus being thus operated; and the D.C. Hughes was ultimately replaced by a Baudot quadruple with complete success. Taking the capacity of the Baudot as 1,550 words per hour, and that of the Hughes as 1,800 words, the total capacity of the line was thus 17,000 words per hour. The Academy of Sciences, in recognition of the economy of line thus effected, has awarded to Mr. Maguna the Kastner-Boursault prize and the Berthelot medal.—*Journal Télégraphique.*

New Zealand.—The Government has received a satisfactory tender for the erection of two high-power and five low-power wireless stations round the coast, which will be completed in six or eight months.

Post Office Telegraph Lines.—The Postmaster-General has introduced a Bill in Parliament to facilitate the construction and maintenance of telegraph lines. It is designed to give him power to place telegraph lines across railways and canals and to maintain or alter the lines so constructed.—*The Times.*

The Telephone Transfer.—The Postal Telegraph and Telephone Controlling Officers' Association has decided to ask the Postmaster-General to appoint a Departmental Committee on which all classes who will be affected by the telephone transfer shall be represented, in order to consider the question of seniority and scales of pay.

Wireless Telegraphy.—A scheme has been carried out during the past six months in German East Africa, at the instance of the Imperial Post Office authorities, in conjunction with the administration of the protectorate. Two stations for wireless telegraphy have been built and equipped by the German company at Muanza and Bukoba on the Victoria Nyanza lake, and the stations are to be brought into operation in the near future. The range of the Bukoba station is limited to 124 miles; it is mainly intended to secure connection between Bukoba and its populous hinterland and Muanza, which is situated on the southern bank of the lake. The inland telegraph line of Dar-es-Salam-Tabora-Muanza terminates at Muanza, and the possibility of forwarding telegrams from the coast by wireless telegraphy to the far distant Bukoba is declared to be needed in the political and military interests of the colony, and also for the more rapid transmission of news, which has hitherto been effected through the Post Office by the mediation of the small English and German steamers on the lake. It is intended that the Muanza station shall have a range of 372 miles, in order to be able to establish connection with the main station, which it is proposed to provide at Tabora next year, and which is to be equipped with apparatus for transmission over a distance of 2,480 miles. The object of the Tabora station is to form a means of communication between German East Africa and the Cameroons, and thus to connect German East Africa with the German cable on the West Coast of Africa. When this work has been carried out, it will secure the independence of the German Government and of traders in German East Africa of the English cable services *via* Zanzibar-Aden, or Zanzibar-Cape Town to Europe, and at the same time, it is said, render possible a reduction of rates for the dispatch of telegrams.

A Marconi wireless telegraph station has been opened at Keeling-Cocos Islands for the transmission of telegrams to and from ships at sea. These islands are already connected by submarine cables, and are now in a position to maintain communication with the Australian liners up to a radius of 250 miles.

On Saturday night there was an outbreak of fire on board the new destroyer *Goldfinch*, at Devonport, which destroyed the wireless telegraph instruments and fittings.

The telegraph cable between Mull and the Island of Tiree having been broken since December 15th, a petition has been forwarded to the Postmaster-General by the inhabitants of Tiree asking, owing to the frequent interruption of communication, that a wireless station be erected at Tiree in order to obviate these mishaps.

A company has been formed to develop Herr Goldschmidt's system for generating mechanically high-power electric waves, to be called the Hochfrequenz-Maschinen Aktiengesellschaft für Drahtlose Telegraphie, with a share capital of £105,000.

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—Tramway storage battery, for the Corporation. See "Official Notices" March 3rd.

Algeria.—April 10th. The Prefectural authorities at Oran are inviting tenders for the concession for the construction and working of an electric tramway, about 29 km. long, between Oran and El-Ancor.

Atherton.—March 27th. Materials, for the U.D.C. Electricity Department. See "Official Notices" to-day.

Australia.—April 18th. One common-battery switchboard, for the P.M.G.'s Department in Western Australia. See "Official Notices" December 23rd.

May 8th.—Battery of accumulators, with boosters and switchboards, for the Melbourne City Council. See "Official Notices" February 24th.

June 14th.—Switchboard, common-battery, multiple, for the P.M.G.'s Department in South Australia. See "Official Notices" February 3rd.

June 14th.—Branching multiple magneto lamp-signalling switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" February 3rd.

April 19th.—Five motor-generators and one switchboard, for the P.M.G.'s Department in South Australia. See "Official Notices" March 10th.

April 25th.—175 miles of telephone cable, lead-covered, paper-insulated, and 717,000 paper sleeves, for the P.M.G.'s Department in Victoria. See "Official Notices" March 10th.

Melbourne.—April 19th. Deputy Postmaster-General. Telegraph and telephone material. Specifications, &c., High Commissioner, 72, Victoria Street, S.W.

Melbourne.—July 25th. Deputy-P.M.G., 12 sections of a branching multiple magneto lamp signalling switchboard, &c., for Geelong. High Commissioner, 72, Victoria Street, London, S.W.

March 29th.—Opalescent arc lamp globes, for the Melbourne City Council. See "Official Notices" to-day.

Austria.—March 20th. The Imperial Tobacco Regie invite tenders for the primary and secondary electric plant for the tobacco factory at Jagielnica. The plant required comprises two oil motors and dynamos, electric lighting and power plant, and three electric hoists. Particulars of Hilfsämterdirektion der General Direktion der Tobacco Regie, Vienna.

Beckenham.—March 20th. Meters, for the U.D.C. See "Official Notices" February 24th.

Blackpool.—March 22nd. Uniforms and caps, for the Tramway Department of the T.C., for a year. Mr. Chas. Furness, general manager.

Bolton.—March 30th. Materials and stores for a year, for the Corporation Electricity Department. See "Official Notices" March 10th.

Bootle.—March 20th. Slack, for the Corporation electric light station, for 6 and 12 months. Borough Electrical Engineer.

Bray.—March 21st. Stores for the U.D.C. electricity works. See "Official Notices" March 10th.

Belgium.—The municipal authorities of St. Josse-ten-Noode, near Brussels, have just invited tenders for an installation of electric lighting in the Town Hall.

March 29th.—The Société Nationale des Chemins de Fer, 14, Rue de la Science, Brussels, is inviting tenders for underground armoured cable, required for the light electric railways in the Brussels district.

Eccles.—March 20th. One 500-K.V.A. steam engine, single-phase generator and exciter, for the Corporation. See "Official Notices" February 24th.

Edinburgh.—The Corporation Electricity Department invites tenders for bitumen, arc lamp globes, cast-iron pipes, pavement boxes, and underground conduits; tenders are also asked for coal supply. Mr. A. Newington, engineer.

Germany.—March 27th. The Prussian State Railway authorities, at Posen, are inviting tenders for the supply and erection of an electrically-operated locomotive turntable.

Gillingham.—March 20th. Materials and stores for a year, and purchase of scrap material, for the U.D.C. Electricity Department. See "Official Notices" March 10th.

Glasgow.—April 24th. Steam turbo-alternator, with condensing plant, for the Corporation tramways. See "Official Notices" to-day.

Govan.—March 28th. Stores for a year, for the Burgh Electricity Department. See "Official Notices" to-day.

Halifax.—March 28th. Electrical fittings, for six months, for the B. of G. A. T. Longbotham, Clerk, 4, Carlton Street.

High Wycombe.—April 5th. Engines, pumps, compressors, turbines, ejectors, and other plant, at the sewage outfall works, for the T.C. Mr. T. J. Rushbrooke, borough surveyor, 77, Easton Street.

Hull.—March 24th. Electric light work in connection with alterations, &c., to premises in Hessle Road, for the B. of G. T. Beecroft Atkinson, architect, 41, Trinity House Lane, Hull.

Hungary.—March 31st. The Grossgemeinde Turocszentmarton call for tenders for the erection of a generating station.

April 1st.—The T.C. of Kolosvar, Hungary, invite tenders for the installation and working of a system of municipal electric tramways. Plans, &c., to be obtained from the Municipal Engineer's office. The tenders, which must include plans, estimates of revenue and technical details, are to be addressed to the Bürgermeisteramt der Kgl. Freitstadt, Kolosvar.

Ipswich.—March 22nd. General stores (not electrical goods) for two years, for the Corporation Electric Supply and Tramways Departments (specification 47). Mr. F. Ayton, chief engineer and manager.

Kingston-upon-Hull.—March 28th. Two 2,000-KW. turbo-alternators, for the Hull Corporation. See "Official Notices" March 10th.

Leigh.—April 1st. One 500-KW. direct-coupled high-speed reciprocating generating set, evaporative condenser, extension to switchboard, and girder work for extension of crane, for the Corporation. See "Official Notices" to-day.

Leeds.—March 31st. Twenty-five tramcar trucks and 10 electrical equipments, for the City Tramways Committee. See "Official Notices" to-day.

Limerick.—March 31st. Materials and stores, for the Corporation Electricity Department. See "Official Notices" to-day.

Liverpool.—March 20th. Electrical fittings, for a year, for the Select Vestry. Mr. G. O. Holloway, acting clerk, parish offices, Brownlow Hill.

London.—March 21st. Electric bellhangers' work, for three years, for the Commissioners of H.M. Works and Public Buildings. See "Official Notices" March 3rd.

L.C.C.—March 28th. Four electric watering-cars, with rail-grinding apparatus, and four complete electrical equipments for the same, to operate on both overhead trolley and conduit systems. See "Official Notices" March 10th.

HAMMERSMITH.—March 29th. High and low-tension switchgear and air-cooled static transformers, for the B.C. See "Official Notices" March 10th.

HACKNEY.—April 6th. Two water-tube boilers, one motor turbine feed pump, and reconstruction of portion of the coal conveying plant, for the B.C. Electricity Department. See "Official Notices" March 10th.

Manchester.—March 21st. The Tramways Committee is inviting tenders for machine tools for the car works. Mr. J. M. McElroy, general manager, 55, Piccadilly, Manchester.

Margate.—March 22nd. Electric lighting of a concert pavilion at the Fort, for the Corporation. See "Official Notices" March 10th.

Perth.—The Corporation Electricity Department invites tenders for 3,500 tons of small coal. Mr. John Lambert, engineer.

Prague.—March 20th. The Imperial Böhmische Nordbahn Direction at Prague invites tenders for three electric motors and a large variety of electric machine tools. Particulars of Abteilung IV, Nordbahn Direction, Prague.

Rawtenstall.—March 31st. One 500-KW. three-phase steam alternator and one 250-KW. motor-generator, for the Corporation. See "Official Notices" to-day.

Reigate.—March 22nd. Two Diesel oil engines coupled to 100-KW. single-phase alternators, with exciters, &c., and main switchboard, for the T.C. See "Official Notices" March 3rd.

Rotherham.—March 23rd. One 1,000-KW. steam turbo-alternator, condensing plant, piping, H.T. switchboard gallery, switchgear, &c., for the Corporation Electricity Department. See "Official Notices" March 3rd.

Sheffield.—March 23rd. Alteration of the present system of electrical fire-alarm bells at the Fir Vale Workhouse to relay-operated system, for the B. of G. See "Official Notices" to-day.

South Africa.—April 3rd. Rand Water Board, Johannesburg. High-lift centrifugal pumps, generating and condenser sets, transformers, poles, insulators, copper wire, &c., and about 29,500 ft. of 16-in. and 29,500 ft. of 18-in. steel pipes and specials. For further particulars, see this column last week.

St. Helens.—March 22nd. Cooling well, Croppers Hill power station, for the T.C. Mr. E. M. Hollingsworth, borough electrical engineer (returnable deposit of £1 1s.).

Tonbridge.—March 20th. Cables, meters, arc lamp carbons and sundry stores, for the electricity department of the U.D.C., for a year. H. W. Peach, clerk, Tonbridge Castle.

Turkey.—March 20th. Tenders are invited for carbons, rubber-covered wire of various diameters, insulators, lead cables, &c. Particulars from the Directeur-Général des Postes et Télégraphes, Constantinople.

Wallasey.—April 13th. Stores for the Corporation Electricity Department, for a year. Mr. J. A. Crowther, electrical engineer.

Wakefield.—March 27th. Three steam superheaters, for the Corporation Electricity Department. See "Official Notices" March 10th.

Warrington.—April 5th. Extra-high-tension cable and extension feeder panel, for the Electricity and Tramways Committee. See "Official Notices" to-day.

Whittingham (near Preston).—March 23rd. Electric sundries, for the Lancashire County Asylum. W. N. Baldwin, clerk and steward.

Wigan.—March 27th. Supplies for the Corporation Electric Lighting and Tramways Departments. See "Official Notices" to-day.

Worksop.—March 28th. Lathe, drilling machine and other accessories, for the U.D.C. Electricity Works. See "Official Notices" to-day.

CLOSED.

Australia.—The *Australian Mining Standard* reports the acceptance of the following tenders:—

VICTORIA (P.M.G.):—

Osram and Robertson lamps.—General Electric Co., Ltd., Sydney, £128.
Various cables, wires and paper sleeves.—W. T. Henley's Telegraph Works Co., Melbourne, £14,280.
Insulators.—British and Foreign Indent Co., £167.
Switches.—J. A. Newton & Co. Proprietary, Ltd., £137.
Piping.—J. Danks & Son Proprietary, Ltd., £561.
Counters, fuses, plugs, &c.—India-rubber, Gutta-percha and Telegraph Works Co., £539.

For Queensland, New South Wales, South Australia and Tasmania P.M.G.'s Departments the British and Foreign Indent Co. is to supply insulators of the respective totals of £622, £1,134, £415 and £153.

Bacup.—Messrs. Glover & Co. have secured the contract for the laying of the cables to distribute electric current in the central portions of Bacup.

Burnley.—The Electricity Department has accepted the tender of the British Westinghouse Co. to supply a turbo-generator of 1,500 KW. The company offer to have the plant running by the beginning of October.

Cheltenham.—The T.C. has accepted the tender of the Electric Construction Co., Ltd., for switchgear, at £229; and that of the Phœnix Dynamo Manufacturing Co., Ltd., for a motor-generator, at £600; for the latter there were 11 tenders, the highest being £935. The Council has also accepted the tender of the London Electric Stores Co. for lamps, for a year; and that of Messrs. Ward & Goldstone for wire, for a similar period.

Dublin.—The Electricity Supply Committee, in a report to the Corporation, recommends the acceptance of the tenders of Messrs. Babcock & Wilcox and the Oerlikon Co., for extensions of the generating plant. In response to the Committee's advertisement, applications for copies of the specification were received from 13 firms, but, owing to the short time allowed for the delivery and erection of the plant, most of the firms were unable to tender. Complete tenders were received from only three firms, Messrs. C. A. Parsons & Co., Willans & Robinson and the Maschinenfabrik Oerlikon. The General Electric Co. sent in a partial tender. Babcock and Wilcox tendered for their well-known boiler plant, pumps, &c., through the three firms which sent in complete tenders, and also submitted the same tender for those sections of the plant to the Committee, in case it was considered desirable to deal with the sections separately. By accepting the tender of Messrs. Babcock and Wilcox direct, the Committee saves £2,000. The other tenders work out as follows:—C. A. Parsons & Co., £11,178; Maschinenfabrik Oerlikon, £11,458; Willans & Robinson, £11,809; General Electric Co., £11,817. The Committee was unable to consider the tenders of Messrs. Parsons and the General Electric Co., as delivery and erection could not be guaranteed by them before November 30th, and as the other two firms had included in their tenders a substantial provision for overtime work on the construction and erection of the plant to enable them to complete by October 31st, the apparent saving on the Parsons tenders cannot be taken into comparison. The city electrical engineer having analysed the details of the contracts, the Committee recommends that the tenders of the Maschinenfabrik Oerlikon, for £11,458, and of Babcock & Wilcox, for £23,240, be accepted. It is clearly set out in the specification that the acceptance of the contract is subject to the approval of the L.G.B. Both firms recommended have, however, agreed to take the risk of this approval being given, and will proceed with the preliminary work the moment the decision of the Council is conveyed to them. If the L.G.B. subsequently withhold their approval, the entire loss of the preliminary work will fall upon the two firms, the Corporation having no responsibility until the sanction of the Board has been obtained.

Edinburgh.—The estimate of the Motherwell Bridge Co. has been recommended by the E.L.C. for the erection of the cooling towers at the Dewar Place electric lighting station, Edinburgh. There were nine tenders. The cost is £18,000.

Glenboig.—The contract for the electrification of Messrs. P. & M. Hurll's Gartliston works, Glenboig, has been placed with the British Electric Plant Co.

Japanese Government.—We congratulate the Power Gas Corporation, Ltd., of Stockton-on-Tees, upon obtaining a very large contract from the Japanese Government for supplying gas producer, electrical and other plant required in connection with the operation of an electric railway. The contract, by the time the work leaves these shores, will probably amount to £150,000 in value (not £100,000, as stated in several of the daily papers). The producer plant will consist of three units, each having three generators, and fitted with apparatus for the recovery of sulphate of ammonia. They will be of the patent "Mond" type. The engines will have two double-acting cylinders placed tandem, direct-coupled to alternators of the fly-wheel type, with a periodicity of 25. The power will be conveyed at high tension to sub-stations, and from there distributed to the railway. The coal to be dealt with will be of very inferior quality, containing nearly 20 per cent. of ash.

Since writing the above, we observe in the *Times Engineering Supplement* that the engines will be made by the Lilleshall Co., Ltd., of Oakengates, Shropshire, the alternators being of the Dick, Kerr

fly-wheel type; that the section of railway to be electrified is between Tokio and Yokohama, and that the power station will be near the latter place. At the outset there will be two sub-stations, and the entire plant is to be in service in two years. The exciters, cranes and other auxiliaries are to be shipped in six months, and the engines and producers in 10 months.

Leith.—At a meeting of the Dock Commission, reports were submitted by Mr. Whyte, the superintendent, and recommendations by the Works Committee, regarding the proposed extension of the electrical installation at the docks. From the reports it appeared that tenders had been obtained from various firms for the work, and it had been agreed to recommend that the tender of the Chloride Electrical Co., amounting to £2,032, should be accepted. The tender covers battery, booster, switchboard, &c. With reference to cables, prices had been received from some of the principal British makers; the prices were practically all the same, about £4,000. A German firm had also been invited to quote. The prices submitted were slightly higher than those of the British firms, but when asked for a definite tender, and when they knew they were in competition with British firms, they reduced their prices by about 16 per cent. all round. The Committee recommended generally in favour of the British manufacturers, and resolved that the orders be placed with them, if they will reduce their price by at least 5 per cent. Failing that the sub-committee is to report further to the Works Committee. It was considered that the laying of the cables would be best done by the Commissioners, and the estimated cost of this was £2,000. The existing lamps at the Imperial and Edinburgh docks will have to be replaced by new lamps, and about 100 will be required at a cost of £1,500. The sub-committee recommended that the Commissioners be asked to approve generally of the scheme and estimates, and remit back with powers to the Works Committee to authorise expenditure for cables up to £6,500 for material and work, and this was agreed to.

London.—Islington.—With reference to our note of accepted tenders published last week, we understand that the B.C. Lighting Department also placed a contract for carbons with Messrs. W. Geipel & Co., their order being for the whole of the flame carbons (145,000).

Newport (Mon.).—The B. of G. has accepted the tender of Mr. G. L. Scott, of Newport, for electric light fittings.

Newton-le-Willows.—A plant driven by electric power, supplied by Messrs. Mather & Platt, Ltd., is to be installed at the works of J. F. & E. Caulfield.

Plymouth.—The T.C. has provisionally accepted the following tenders for annual supplies for the Electricity Department:—

Cables.—British Insulated and Helsby Cables, Ltd., £91.
Carbons.—Crompton & Co., Ltd., £8 16s. 6d. per 1,000 ft.
House meters.—Ferranti, Ltd.
Transformers.—British Electric Transformer Co., (*a*) average per KW. £1 14s., (*b*) average per KW. £1 13s. 11½d.

The Council has further accepted the tender of the Lorain Steel Co. for the supply of 50 tons of tramway rails, at £6 19s. 9d. per ton, together with the necessary quantities of standard 26-in. joints at £8 10s. per ton, and soleplates at £9 10s. per ton.

Shrewsbury.—Messrs. G. H. Smallwood & Co. have obtained the contract for the electric lighting of the new Secondary Schools, at the Priory, Shrewsbury, and for the electric lighting of the new Corporation stables.

Stretford.—The U.D.C. is to purchase from the Tudor Accumulator Co., Ltd., a milking booster, at £37; also from the Lea Recording Co. a water meter, at £90.

Sunderland.—The T.C. has accepted the following tenders:—

B.I. and Helsby Cables, Ltd.—Low-tension lead-covered cable.
Henley's Telegraph Works Co.—19/20 and 19/18 V.I.R. service cable.

Taunton.—The T.C. has accepted the following tenders for switchgear for reconstructing the main switchboard, in accordance with the regulations of the Board of Trade:—

British Thomson-Houston Co., Ltd.—17 automatic oil-break switches, with trip coils and gear, at £3 6s. 9d. each—£56 14s. 9d.; 10 non-automatic oil-break switches, at £2 13s. 6d. each—£26 15s.
Johnson & Phillips.—Nine instrument transformers, at £1 1s. each.

Tucuman.—Messrs. Jens Orten-Böving & Co. have just received the order of the Tucuman Power Co. for three Francis turbines of 1,800 H.P. and two of 200 H.P. working under a head of 100 metres.

West Ham.—The Corporation has accepted the following tenders for annual supplies:—

A.C. house-service wattmeters.—British Thomson-Houston Co., 5 and 10-amp. size; General Electric Co., 25 and 50-amp. size; British Westinghouse Co., 80-amp. size.
Single-phase A.C. motors and two-phase A.C. motors (semi-enclosed).—Fuller Electrical Co.
Two-phase A.C. motors (open type).—British Westinghouse Co.
India-rubber-covered wires and cables (non-Association grade).—Armorduct Manufacturing Co.
India-rubber-covered wires and cables (Association grade) and flexible wire.—Pirelli & Co.
Paper-insulated cables.—British Insulated and Helsby Cables, Ltd.
Electrical fittings and accessories.—Davies, Kent & Stewart; J. H. Tucker and Co.; Baxter & Caunter; Electrical Co., Ltd.; Falk, Stadelmann and Co.; Feld Bros. & Co.; General Electric Co.; B.I. and Helsby Cables, Ltd.; Evered & Co.; Siemens Bros. Dynamo Works, Ltd.

Wolverhampton.—The T.C. has accepted the tender of the British Electric Transformer Co., at £456, for two 300-KW. transformers.

Weymouth.—The Education Committee has accepted the tender of Mr. Rankin, of Weymouth, for installing the electric light at the new Melcombe Regis boys' school, at £55. The only other tender received was from Mr. Tett, at £70.

Whitehaven.—The Corporation has accepted the tender of the Bastian Meter Co., Ltd., for 3-ampere meters for the ensuing year. Messrs. Chamberlain & Hookham have received the contract for prepayment meters.

Yarmouth.—The Corporation has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for 3,000 tons of Scotch anthracite washed nut coal, for their electric lighting works, at 9s. 9d. net per ton, f.o.b. Firth of Forth port. No tender was accepted for 5,000 tons of Derbyshire fine slack coal, and the electrical engineer was directed to advertise again.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued:—

Commanding Officer—Lieut.-Col. H. M. Leaf.

Monday, March 20th.—"A" Company. Infantry drill, 7 to 7.30 p.m. technical drill, 7.30 to 10 p.m.
Tuesday, March 21st.—"B" Company. Technical drill, 7 to 10 p.m.
Thursday, March 23rd.—"C" Company. Technical drill, 7 to 10 p.m.
Friday, March 24th.—"D" Company. Recruits' infantry drill, 6.30 to 7.15 p.m.; technical drill, 7.15 to 10 p.m.

(Signed) P. H. Campbell, Capt. R.E., Adjutant.

FORTHCOMING EVENTS.

Nottingham Engineering Society.—Friday, March 17th. At 6.45 p.m. At Victoria Station, Nottingham. Annual dinner.

Royal Institution.—Saturday, March 18th. At 3 p.m. Lecture on "Radiant Energy and Matter," by Prof. Sir J. J. Thomson. (Lecture III.)
Saturday, March 25th.—At 3 p.m. Lecture on "Radiant Energy and Matter," by Prof. Sir J. J. Thomson. (Lecture IV.)

Royal Society of Arts.—Monday, March 20th. At 8 p.m. Cantor lecture on "Applications of Electric Heating," by Prof. J. A. Fleming. (Lecture III.)

Institution of Electrical Engineers (Newcastle Local Section).—Monday, March 20th. At 7.30 p.m. At the Armstrong College, Newcastle. Continuation of discussion on Mr. C. Vernier's paper on "The Laying and Maintenance of Transmission Cables."

Institution of Civil Engineers.—Tuesday, March 21st. At 8 p.m. Further discussion on Mr. P. Dawson's paper on "The Electrification of a Portion of the Suburban System of the L.B. & S.C. Railway."
Wednesday, March 22nd.—Students' visit to the Chingford Reservoir under construction for the Metropolitan Water Board.
Friday, March 24th.—At 8 p.m. Students' meeting. Lecture on "The Uses of Chemistry in Engineering," by Mr. J. Swinburne.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, March 21st. At 7.30 p.m. At the University, Manchester. Paper on "Electricity Meters," by Messrs. H. A. Ratcliff and A. E. Moore. (Meeting not held on March 14th, as announced last week.)

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, March 21st. At 7.30 p.m. At the Municipal School of Technology, Manchester. Annual general meeting.

Institution of Electrical Engineers.—Thursday, March 23rd. At 8 p.m. Paper on "Electricity Meters, with Notes on Meter Testing," by Messrs. H. A. Ratcliff and A. E. Moore.

Physical Society.—Friday, March 24th. At 5 p.m. At the City and Guilds (Engineering) College. Papers on "A Sensitive Thermo Regulator," and "Experiments on the Measurement of Electrolytic Resistances using Alternating Currents," by Mr. H. F. Haworth; and "Oscillatory Currents in Coupled Circuits," and "Some Radio-Telegraphic Apparatus in use at the City and Guilds (Engineering) College," by Prof. G. W. O. Howe.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, March 25th. At 5 p.m. At the Park Hotel, Cardiff. Abstract reading and discussion on the "Report on the use of Electricity in Mines"; and resumption of discussion on Mr. J. Simpson's paper on "Three-phase Motors for Haulage in Mines."

Manchester Association of Engineers.—Saturday, March 25th. At 7 p.m. At the Grand Hotel, Manchester. Annual general meeting.

The Welsbach Co.—At a meeting held in London recently, Lord Weardale presiding, a resolution was passed winding up and reconstructing the company, the Germany company (Deutschen Gasglühlicht Aktiengesellschaft Auergesellschaft zu Berlin) having made overtures for purchase, and after investigation of the offers the directors advised acceptance. To sell their business as a going concern was a course they should prefer in view of the ever-formidable competition. The chairman said that the German company's ordinary dividends had been in 1906 and 1907, 22 per cent.; in 1908, 35 per cent.; and in 1909 and 1910, 50 per cent. The management of the English company had been attacked because they had not been able to do what the German company had done under a protective system. The bulk of the German company's recent dividends had been due to the success of the Osram lamp and not to the incandescent gas lighting section of the trade. It would be possible for them with the co-operation of the English and Austrian companies, whose abstention from competition would be secured by the acceptance of the offer, to make substantial economies and extensions. The chairman mentioned that there had been no profit on the English business during the past year, and the business was not improving.

Broken Wire Claim.—At Bridgwater County Court on Saturday, the Borough Electric Light Co. successfully brought a case against Messrs. Randle & Sons, timber merchants, who felled a tree and allowed it to fall on to the company's wires, doing damage to the amount of £3 1s. 2d.

NOTES.

Live-Steam Feed Heating.—A correspondent writes :—One good result of the discussion on this subject has been to bring forward the almost forgotten work of Sir W. Anderson, who demonstrated before the Institution of Civil Engineers many years ago that the heat transfer through a plate per degree of temperature difference when the water was actually boiling was more than double what it was when being heated. If this be quietly thought over, it only seems rational, for a unit weight of water when passing into steam has very powerful heat absorptive action. The molecules absorb heat at the rate of 966 thermal units per pound without changing their temperature, whereas below the boiling point the molecules only absorb one unit of heat for a change of 1° of temperature ; so serious a physical difference as these facts indicate must surely have an influence upon the plate which cannot be summarily dismissed as a synonym for changing sixpence. Let another fact be remembered. Many of your readers have perhaps seen men take a bit of waste and clean their hands in the steam jet from the water gauge of a boiler under pressure. The writer has done it frequently. It is easily done in safety, but the hands must be kept at a certain critical distance from the jet. Too close or too far off especially there is a scalding effect. Now, why is the steam so cool at a particular locus, and whence comes back its temperature, say, about 18 in. or less further away ? Is it because at the cold area the steam has done work in thrusting away the atmosphere, whereas further off the steam is heated by the recoil of the air which does work on the steam ? The writer has never seen an explanation of this curious behaviour, and never been able to arrive at a convincing explanation for himself. There the facts are, and if improbable at first sight the facts remain for the unbeliever to verify or disprove. But it will be difficult to disprove in the face of the actual deed, which many of your readers can do for themselves.

£10 : "To Help him to Live Up to it."—An interesting debate followed upon an application by Mr. Hy. Harding, chief assistant engineer, for a revision of his salary, to the Acton Electricity Committee, on Monday evening. Mr. Harding said he had been with the Council over 5½ years. He commenced with £130, and was now receiving £160. This maximum he had been at for the past two years, and his present duties and responsibilities were more than doubled. His position was a very responsible one, and the salary paid was less than was usually paid for similar appointments, and also less than the chief assistants received in other departments of the Council.

Councillor Scofield said here was a man with technical training, and he did think they were treating him a bit niggardly. Battersea paid its chief assistant £225, Bermondsey £230 rising to £250, Hammersmith £300, Ealing £280, Willesden (there they had a chief clerk) £180 rising to £200, and Hampstead £400.

The Chairman said he thought they might very well in this case recommend an extra £10.

Councillor Scammell : I move that no recommendation be made at all. We are losing quite enough on the undertaking as it is. I don't think a chief assistant is necessary at all. We give him a name, and he wants a salary to live up to it.

Mr. J. Martin Blair (electrical engineer) said Harding was a very strenuous worker, and in his absence took sole charge.

It was agreed that the application, without any recommendation, be passed on to the Establishment Committee, and the same course was followed in the case of a similar request by Mr. H. C. Calogreedy, charge engineer.

Electro-Harmonic Society.—The last smoking concert of the season will be held at the Holborn Restaurant (King's Hall), on Friday evening, March 24th, commencing at 8 o'clock. The programme is as follows ; Vocalists—Mr. Hubert Elsdell (tenor), Mr. Graham Smart (bass-baritone) ; Zither-banjoist, Mr. A. E. Nickolds ; Feats of legerdemain, Mr. Leslie Lambert ; Scotch comedian, Mr. Sandy Lawson ; Society entertainer, Mr. Vivian Foster ; Songs at the piano, Mr. Wilden Knight ; Humorous sketches at the piano, Mr. Archie Naish, and a string orchestra—conductor, Mr. L. C. Venables.

L.C.C. Highways Committee.—The minutes for last Tuesday's meeting of the L.C.C. contained the following as the names of the proposed members of the Highways Committee for the ensuing year :—

Shirley Benn, A.	Pakenham, Col. H. A.
De Forest, The Baron.	Reynolds, Walter.
Gillett, G. M.	Smith, Frank.
Goff, T. C. E.	Squires, W. J.
Gordon, H. H.	Stuart, R. L.
Hall, F.	Ward, Henry.
Hume, G. H	White, Edward.
Hunt, W.	Yeo, A. W.

Railless Traction.—Mr. Adkins asked the President of the Board of Trade the other day whether his attention had been called to the fact that there were before Parliament a number of Private Bills which contemplated railless traction along a large number of public highways, and what steps he proposed to take to secure the application of general and equitable regulations to enterprises of this kind. Mr. Buxton, in reply, said that he was consulting with the authorities of both Houses of Parliament as to the steps which should be taken for dealing with them.

Stoke-on-Trent Electricity Department Dinner.—The first annual dinner of the staff of the electrical engineer's department of the county borough of Stoke-on-Trent took place on March 2nd, at the Grand Hotel, Hanley. The chair was occupied by Councillor H. Leese (Chairman of the Electricity Supply Committee), and there was a large gathering, which included Councillors Harper Parker and Lovatt. Mr. H. W. Edwards (Burslem District), in toasting "The Committee," spoke very warmly of the chairman and the Committee for the way in which they had dealt with the serious and complicated problems that had come before them. The Chairman, in responding, said it was the object of himself and the Committee to deal thoroughly and conscientiously with the problems to be faced in connection with their undertakings, and although they were subject to much lay criticism, they did not mind that, knowing they had done their duty and gone deeply into the matters in hand. Mr. Councillor Harper Parker, in proposing "The Undertakings," said he was sure that with the engineer they had the undertakings would be a great success. Mr. Yeaman was not only an electrical and mechanical expert ; he was a splendid organiser, and dealt with his staff in a most praiseworthy and humane manner. Mr. Yeaman, in reply, laid stress upon the importance of the younger members of the staff equipping themselves for the future and being fully prepared, physically and mentally, to meet the demands likely to be made upon them. "The Electrical Contractors," proposed by Mr. Cuthbertson (Longton District), was aptly responded to by Mr. C. Osborne (Blackburn, Starling & Co., Ltd.), Mr. Gould (Barnett and Soans), and Mr. Francis. Mr. Councillor Lovatt proposed the health of the new members of the staff, and gave them a hearty welcome to their positions. This toast was responded to by Mr. Turnbull (Stoke District). "The Visitors" was proposed by Mr. Adams (Hanley District), and responded to by Mr. Hatch (Potteries Electric Traction Co., Ltd.), Mr. Hulse (British Westinghouse Electric Co., Ltd.), Mr. Mackay (Stirling Boiler Co.), and Mr. A. M. Walker, of the borough treasurer's department. Messrs. Bailey, Bridgeman, Durose and Thomas rendered musical items, and Mr. Councillor Lovatt gave some recitations. Mr. Charles Osborne also contributed musical items to the programme.

Fatality.—A boy of 10 years of age climbed over a 4 ft. 6 in. wall on to the L. & Y. Railway at Southport. Stumbling, he fell against the live electric rail ; apparently his head was against one rail and his feet were against another. A train coming along could not be stopped in time, and the lad died from a fractured skull, due to a blow from the train. At the inquest a good deal of attention was given to the inadequate height of the wall, and the jury, in returning a verdict of "Accidental death," suggested that the wall in question, and the walls in the immediate neighbourhood, should be made considerably higher, so as to be unclimbable.

The Aluminium Price Question.—It is stated that the large producers of aluminium on the European Continent have arrived at an understanding to keep the price at 68s. per cwt. until further notice. No great importance is attached in trade circles to this arrangement, which is not bound by any eventual fine for non-observance. Nevertheless, it seems not to be out of the question that under the circumstances there may be evolved from the understanding the binding convention which has been aimed at for a long time past. The new arrangement is also of no importance to consumers for the time being, as large users are already covered for the next few months at cheap prices, so that but little demand exists from this quarter. For the rest, the market price for large quantities of aluminium has recently corresponded with the price of 68s. per cwt. which now forms the new arrangement.

Royal Metal Trades' Pension Society.—The annual ball of the society, at which Mr. F. A. B. Lord (of Messrs. W. F. Dennis & Co.) was chairman, has resulted in the fund benefiting to the extent of just under 200 guineas, which is a very fair average.

Legal.—Connolly Bros., Ltd.—After our report on p. 421 was made up on Wednesday, Mr. Justice Parker gave his reserved judgment. He said that Connolly Bros., Ltd., issued first mortgage debentures for £30,000, which were a floating charge on all the property of the company, and by the terms of their issue the company were prevented from creating any mortgage on their property to rank in priority to, or *pari passu* with, those debentures. On January 15th, 1901, certain property was specifically mortgaged to trustees as security for the debenture-holders, and the trustees of that deed were the Liverpool Mortgage Insurance Co. and another. On March 30th, 1904, the company acquired a piece of land ; on April 6th in the same year they deposited the deeds with Mary O'Reilly to secure an advance of £1,000. In 1907 a second series of debentures were issued, the trustees of both series being the same. Under those circumstances, the question was whether the O'Reilly mortgage could rank in priority to the first debentures, and that question could be determined in either action. Clearly, however, both actions ought not to proceed. One ought to be stayed, and it was clearly a matter of convenience which ought to proceed. It was clear that the debenture-holders' action could not be stayed altogether, and O'Reilly was certainly a necessary party to it. The defendant O'Reilly, however, contended that this Court had no jurisdiction to restrain him from proceeding with the Palatine action. That contention could not be supported, and Mr. O'Reilly must be restrained from proceeding with the Palatine action and taking any steps in it. As the receiver appointed for Mr. O'Reilly was an officer of the Palatine Court, he thought the proper thing to do would be to apply in that Court for his discharge. If the plaintiffs' receiver sought to take

possession of the property specifically charged to O'Reilly, he ought to be charged with some rent that could be claimed by Mr. O'Reilly, if at the trial he should turn out to be right, and if not, he ought to be at liberty to make the property profitable in some other way. The costs of the motion would be costs in the debenture-holders' action. Leave was given to Mr. O'Reilly to appeal.

Institution and Lecture Notes. — Northampton Institute.—On Saturday, 11th inst., the ninth annual dinner of the Past and Present Day Students took place at the Holborn Restaurant, Mr. E. T. Driver presiding. The function scored a record attendance, including Dr. Walmsley, principal of the Institute, the heads of the various technical departments, and many past students who have attained successful positions in the engineering world. Dr. Walmsley, in his speech, summarised the growth of the Institute's technical work, and forecasted still further developments in the near future. Mr. S. Field, A.R.C.S., head of the Technical Chemistry Department, in the course of an entertaining speech, suggested the use of an "oxygen chamber" for the purpose of revivifying overworked students. In responding to the toast of the "Past Students' Association," the president, Mr. J. C. Rennie, gave a brief summary of the successful meetings which the Association had held during the past session, and exhorted the present students to join the Association at the earliest possible date and take full advantage of its arrangements. The "Northampton" spirit of good fellowship pervaded the evening from start to finish, "Auld Lang Syne" being sung at 11.15 p.m.

Association of Mining Electrical Engineers (West of Scotland Branch).—At a meeting of the above in Glasgow, Mr. James Benson, colliery manager, Boringbridge, read a paper on "Compressed Air *versus* Electricity in Mines." He said that comparison between the use of compressed air and of electricity was too often founded on the removal of antiquated plant driven by the former and the substitution of up-to-date electrical machinery. With modern compressed-air plant there was very little difference in the cost. Compressed air was entirely safe under any mining conditions, and could be used and handled by the most careless with the greatest impunity. He, however, knew of nothing better for raising water than electricity when applied to the turbine pump, but he thought the manufacturer made a great mistake in desiring to get the highest efficiency. Conditions underground both for cutting and haulage were so severe that all the apparatus must be of the very best construction.

Institute of Marine Engineers.—The annual report of the Council, submitted to the meeting on Friday last, shows a material increase in the membership, and a balance of £3,319. A special fund has been opened for the purchase of premises in the City of London. New by-laws have come into force, whereby one-third of the Council retire every year and are ineligible for re-election for one year.

Institution of Electrical Engineers (Glasgow Local Section).—On Tuesday last, in place of the ordinary meeting, the Committee held an informal Conversational Gathering. The membership of Edinburgh, Leith and district having just been incorporated with the Section, it was felt that this meeting would afford a very suitable occasion for welcoming the new adherents to the Section.

Royal Institution. — In his second lecture on "Radiant Energy and Matter," last Saturday, Sir J. J. Thomson corrected his statement of the energy radiated from the sun, which he estimated at 10,000 to 15,000 H.P. per square *foot*, not per sq. cm.

At a meeting of the Blackburn and District Managers' Mutual Association recently, Mr. E. Preece delivered a lecture on "Electric Driving in Textile Mills," in the course of which he pointed out that about 30 mills in Lancashire and Yorkshire were driven by electricity, varying from 400 to 3,000 H.P. In the discussion which followed, Mr. P. P. Wheelwright, electrical engineer for Blackburn, said the cost of driving a mill by electricity would not be less than the cost of steam, but the output of the material would be increased so much that the increased cost for power would become negligible.

Before the Liverpool Engineering Society, on March 8th, Mr. J. K. Catterson-Smith read a paper on "The Manufacture of Turbo-electric Generators, and some of their Applications to Marine Work."

Birmingham Electric Club.—At a meeting on Saturday, Mr. C. Bell-Walker read a paper on "Small Electric Lighting Plants."

Appointment Vacant. — Improver, for the Bristol Corporation Electricity Department. See our advertisement pages in this issue.

For Sale.—The Coventry Corporation has for sale by tender a 300-KW. two-phase 2,000-volt 50-cycle Siemens alternator, coupled to a Belliss three-throw compound engine. The Worksop U.D.C. has for sale a quantity of old accumulator material. See our advertisement pages in this issue.

Electric Fountain.—A special feature at the Scottish National Exhibition, to open in May, for six months, is to be the electrically-illuminated fountain. This consists of an ornamental water basin divided into an inner and an outer compartment, with a chamber beneath the inner basin. The diameter of the outer basin is over 50 ft., with an outer ornamental wall standing about 2 ft. above the ground level. The subterranean chamber contains eight large electric projectors and their controlling equipment. The electrical illumination of the fountain is effected by means of the eight projectors, each lamp having a "Neosiler" reflector, the light from the reflector being projected through eight strong hardened-glass plates, fixed in the centre basin above the subterranean chamber. To produce variety of colour effects, 32 frames are necessary, each of which is covered with complete sets of colours on specially prepared glass strips, the frame moving between the hardened-glass plates and the reflectors by means of a system of special guides. Over 20,000 C.P. is used to produce the effects, and over 300 gallons of water per minute will be discharged from the jets.

Electric Rolling-Mill Trains.—A paper dealing with the subject of applied electricity in American mines and ironworks was recently read before the German Association of Mechanical Engineers by Mr. E. Eichel, of Berlin, who stated that the number of large electrically-operated rolling mills in the United States was small. On the other hand, the list of German instances of important rolling-mill driving by electricity had assumed a considerable extent. According to the latest reports, the author said, the A.E.G. and the Siemens-Schuckert Works had supplied, or had under construction, 29 installations of reversing rolling-mill trains alone, of a total of 226,030 H.P., including motors having an individual output of 12,800 H.P. The superiority of German electrical engineering in this respect, in the opinion of the author, was proved by the many installations carried out by German firms in Austria-Hungary and France, and even in England.

German Commercial Methods in Japan.—United States Consul-General Thomas Sammons, at Yokohama, Japan, reports that German manufacturers recently secured an order in Tokyo for electrical apparatus and water-wheels amounting to approximately £190,000. This order was placed by the Tokyo Electric Light Co., and included six 7,700-KW. generators and water-power turbines, 12 4,000-KW. transformers, 12 3,600-KW. transformers and corresponding switchboard apparatus. Of the above-named apparatus the Allgemeine Elektricitäts-Gesellschaft, of Berlin, obtained an order for about 75 per cent., namely, approximately £80,000 for electrical apparatus and £60,000 for the water-wheels. The Siemens Co., of Berlin, obtained an order for approximately £35,000 of the electrical apparatus, and the Shibaura Engineering Works, of Tokyo, in which the General Electric Co. is interested, obtained an order for only about £10,000 of the electrical apparatus. Consul Sammons reports that he has made a careful investigation of the prices made by the German firms and the conditions under which the order was taken, and finds that the Germans, on the electrical apparatus, were only about 9 per cent. lower than the chief American competitor, the General Electric Co. These German quotations were at first understood to be quite radical; that is to say, 25 to 30 per cent. below American prices. It is evident, however, that some of the German manufacturers are quite willing to sell below cost in certain instances with a view to meeting competition and securing control of desirable markets. —*Electrical World.*

A New Fair Fare System; or How to make the Passenger Pay.—In a recent American Consular report on the electric tramways of Prague, Austria, it is mentioned that in addition to their usual "compensation," the conductors expect, "and usually receive," from each passenger a tip of two hellers, which amounts to one-fifth of a cent. This is said to amount to about as much as the conductors' "regular compensation." Conductors and motormen are taken on trial for three months, and for the first year they receive $0·53 a day, or $193·45 a year. According to length of service this rises, until after 11 years they receive $0·69 a day, or $251·92 a year. Then they receive 25 per cent. advance. After 35 years they are pensioned at $314·90, the amount of their full salary. We can imagine those $193·45 men, or even the $251·92 men, with a family to support, demanding those two hellers per passenger with a considerable zest. A little more at that end of life, and a little less at pension age, might commend itself to some English minds as a more reasonable arrangement, and in regard to those two hellers, well, we hope that system will begin and end at Prague—we prefer to pay our fare and be done with it.

Electrical Propulsion of Ships.—We understand that Mr. Durtnall has recently secured the grant of Letters Patent for his system of electrical propulsion in Germany, as well as other European countries, and has been instructed by several firms at home and abroad to draw up practical schemes for them.

Australian Railway Electrification.—According to the *Standard*, Mr. Wilson, the partner of Mr. Merz, is urging the Government to adopt the Merz scheme of electrification of the Melbourne suburban railways.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Electricity Committee of Plymouth Town Council has provisionally granted the following increases of salary:—Mr. F. Hayes, assistant electrical engineer, £200 raised to £225 per annum; Messrs. F. G. Jones and E. Tilby, charge engineers, salaries increased from £144 to £150 per annum.

Mr. W. F. Stamp is resigning his appointment of assistant (chief) engineer with the Devonport Corporation after nine years' service in that position.

Mr. P. G. Campland, works superintendent at the Weymouth electricity works, has been appointed third engineer at the Bermondsey Corporation electrical and destructor works.

The Dover Town Council has appointed Mr. H. Parker, of Gillingham, as shift engineer.

Mr. J. R. Clegg, of Guildford, has been appointed shift engineer at the Dewsbury Corporation electricity works.

On Monday last Mr. John McMillan, chief engineer Falkirk Corporation electricity works, was presented by the staff of the department with a pocket aneroid barometer on the occasion of his leaving Falkirk for British Columbia. Mr. Sharp, chief assistant, made the presentation.

Tramway Officials.—The Aston Corporation on Wednesday night appointed Mr. Ernest Holt, the chief clerk, as manager of the Corporation tramways at a salary of £156 per year. He succeeds Mr. J. W. Dugdale, who has been appointed manager at Oldham. On March 8th Mr. Dugdale was presented by the employés with a fumed oak smoking cabinet and a silver-mounted pipe. Mr. Holt made the presentation.

The *Australian Mining and Engineering Review* states that the Launceston (Tas.) City Council has appointed Mr. J. E. Jinks traffic superintendent of the municipal electric tramways. He at present holds a similar position with the Bendigo (V.) electric tramways.

Mr. H. Yerbury, M.Inst.C.E., M.I.E.E., M.I.Mech.E., chief engineer to the Sheffield Corporation Tramways Department, is shortly to be married to Miss Dorothy Wood, daughter of Mr. W. W. Wood, of Sandygate, Sheffield.

General.—Mr. W. Payne, late superintendent of the instrument room of the telegraph department of Glasgow Post Office, whose official service extends over 46 years, was presented with an antique grandfather's clock from the male members of the staff, together with a candelabra and gold bangle for Mrs. Payne from the lady members.

Mr. E. V. Buchanan, belonging to Hamilton, Lanarkshire, has just been elected chief electrical engineer to the city of London, Ontario, Canada.

According to *Commercial Intelligence*, Mr. W. Hutchinson, Chief Engineer for Railway and Tramway Construction, Sydney, New South Wales, is on his way to Europe to study railway and tramway construction.

Dr. J. A. Ewing, F.R.S., Director of Naval Education, was on 9th inst. quietly married at Christ Church, Westminster, to Miss Ellen L. Hopkinson, daughter of the late Dr. John Hopkinson. Prof. Hopkinson, of Cambridge, gave his sister away.

Obituary.—Mr. W. I. Taylor.—The death occurred suddenly on 10th inst., at his residence at Enfield, of Mr. William Isaac Taylor, M.I.Mech.E., M.I.N.A., M.I.Mar.E., M.I.E.E., at the age of 62 years. Mr. Taylor was representative and director in London of Messrs. Clarke, Chapman & Co., Ltd., and the Darlington Forge Co.

Dr. F. A. Kjellin.—The *E.T.Z.* last week recorded the death of Dr. F. A. Kjellin, the inventor of the first practical form of the electrical induction furnace, which took place on December 30th last in Stockholm. He was only 39 years old.

Mr. M. B. Cotterell.—We learn with great regret of the death of Mr. M. B. Cotterell, for many years a director of Messrs. Veritys, Ltd. The deceased gentleman was only 41 years of age, and he passed away on 13th inst. at his residence at Manchester, the cause of death being pneumonia. The funeral took place yesterday, and the Manchester offices of the firm were closed for the day.

NEW COMPANIES REGISTERED.

International Russian Corporation, Ltd. (114,310).—This company was registered on February 21st, with a capital of £200,000 in £1 shares, to acquire, prospect, explore, develop and work lands, timber and oil rights and claims, mines, minerals, ore, mining and water rights, claims and concessions, or rights to construct and work railways, tramways, electric lighting systems, electrical and other power installations and works in the Russian Empire or elsewhere, to carry on business as company promoters, contractors, traders, explorers, merchants, &c., and to adopt an agreement with the Russkoye Gornopromyshlennoye i Commissionnoye Obschestvo (the Russian Mining and Commission Co.). The first issue of capital is to be £40,000 shares, divided into four groups of 10,000 shares each. The subscribers (with one share each) are:—L. Albu, Winchester House, Old Broad Street, E.C., merchant; O. Kirsch, 24, St. Mary Axe, E.C., merchant; A. F. P. Roger, 9, Cloak Lane, Cannon Street, E.C., financial secretary; D. Soskice, 90, Brook Green, W., Russian barrister. Private company. The first directors are to number not less than four or more than eleven. The number of first directors is to be nine; the first are His Excellency Michael Michaelovitch Federoff, and a second director nominated by him as representing the first group of shares; L. Albu and J. S. Austen as representing the second group; C. L. Dreyfus and H. H. Harjes as representing the third group; J. G. White and a second director nominated by him as representing the fourth group; and B. B. Soldalenkow representing the Russian Mining and Commission Co.; remuneration three guineas each per board meeting attended, and 5 per cent. of the net profits, divisible. Registered office, Winchester House, Old Broad Street, E.C.

Blum & Co., Ltd. (114,344).—This company was registered on February 23rd, with a capital of £2,500 in £1 shares, to acquire any patents or rights relating to gramaphones or to electrical apparatus, and to adopt an agreement with the Sound Recording Co., Ltd. The subscribers (with one share each) are:—J. L. Blum, Strand Palace Hotel, W.C., merchant; R. Hellendall, 19, Stratford Place, W., merchant. Private company. The number of directors is not to be less than two or more than five; the first are J. L. Blum and R. Hellendall. Registered office, 89, Chiswell Street, E.C.

Fred Price & Co., Ltd. (114,372).—This company was registered on February 24th, with a capital of £2,000 in £1 shares, to carry on the business of electricians, electrical engineers and contractors, garage keepers, suppliers of electricity, petrol or other motive power. The subscribers (with one share each) are:—F. Price, 29, North Luton Place, Cardiff, electrical contractor; R. Lane, 3, Duke Street, Cardiff, hair dresser. Private company. The number of directors is not to be less than two or more than five; F. Price is first managing director; qualification of managing director, £500; of other directors, £20; remuneration, £1 each per board meeting attended. Registered office, 6 and 7, St. John's Square, Cardiff.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Paignton Electric Light and Power Co., Ltd. (98,437).—Issue on January 11th of £2,000 debentures, part of a series of which particulars have already been filed.

Royce, Ltd. (63,871).—Particulars of £13,000 debentures, created February 4th, 1911, and secured by trust deeds dated March 25th, 1903, and January 16th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, except uncalled capital. Trustees: D. F. Basden, 33, St. Swithin's Lane E.C.; and T. G. Mellors, King John's Chambers, Nottingham.

Hankow Light and Power Co., Ltd. (87,331).—Particulars of £12,000 debentures, created August 15th, 1910, and secured by trust deed dated January 27th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Company's land in the Russian Concession at Hankow, China, and concessions granted to the company by the British, Russian and French Municipal Councils, and company's other assets, present and future, including uncalled capital. Trustees: G. G. Watson and E. R. Day.

Brook, Hirst & Co., Ltd. (95,264).—Return dated December 12th, 1910. Capital, £20,000 in £1 shares. 12,500 shares taken up. £12,500 considered as paid. Mortgages and charges: £7,000.

Burmah Electric Tramways and Lighting Co., Ltd. (75,090).—Return dated December, 1910, filed January 21st, 1911. Capital £200,000 in £5 shares (20,000 preference). All shares taken up. £100,000 paid on the preference. £100,000 considered as paid on the ordinary. Mortgages and charges: Nil.

Archibald J. Wright, Ltd. (79,117).—Return dated January 12th, filed January 17th, 1911. Capital £3,000 in £1 shares (2,980 ordinary and 20 deferred). 2,007 ordinary and 6 deferred shares taken up. £1 per share called up on 7 ordinary. £7 paid. £2,006 considered as paid on 2,000 ordinary and 6 deferred. Mortgages and charges: Nil.

Adelaide Electric Supply Co., Ltd. (84,209).—Return dated December 19th, 1910, filed January 16th, 1911. Capital £400,000 in £5 shares (30,000 6 per cent. cumulative preference). 30,000 ordinary and 30,000 preference shares taken up. £5 per share called up on 30,000 preference and 4,000 ordinary. £170,000 paid. £130,000 considered as paid on 26,000 ordinary. Mortgages and charges: Nil.

Electrical Industries Development Co., Ltd. (89,461).—Return dated December 31st, 1910, filed January 19th, 1911. Capital £25,000 in £1 shares (20,000 preference). 9,007 preference and 5,000 ordinary shares taken up. £1 per share called up on 4,007 preference. £4,007 paid. £10,000 considered as paid on 5,000 preferred and 5,000 ordinary. Mortgages and charges: Nil.

Morris & Lister, Ltd. (102,368).—Particulars of £4,500 debentures, created February 15th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to first debentures. No trustees.

Nairobi Electric Power and Lighting Co., Ltd. (87,728).—Issue on February 15th, 1911, of £2,000 third debentures, part of a series of which particulars have already been filed.

Cowans, Ltd. (57,378).—Debenture dated January 20th, 1911, to secure £300, charged on the company's property, present and future, including uncalled capital. Holder: Switchgear Co., Ltd., Wilfred Street, Salford, Manchester.

A memorandum of satisfaction in full of debenture dated December 8th, 1910, securing £300, has been filed.

Debenture dated February 14th, 1911, to secure £300, charged on the company's property, present and future, including uncalled capital. Holders: T. G. Cowan, 18, Austin Friars, E.C.; and P. Still, 19, Cadogan Gardens, S.W.

Anglo-Norwegian Aluminium Co., Ltd.—Charge on raw materials supplied by the company to and remaining in the possession of Nigelands Brug, whether in the raw state or in course of manufacture, and the aluminium or other products made therefrom, dated January 31st, 1911, to secure £15,000. Holders: German Bank of London, Ltd., 34, Old Broad Street, E.C.

Leeds Electric Co., Ltd. (92,285).—Particulars of £1,000 debentures, created by resolutions of August 17th and December 1st, 1910, and secured by trust deed dated February 3rd, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £600. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Church Stretton Electric Supply Co., Ltd. (80,857).—Further charge on freehold hereditaments at Crossways, Church Stretton, Salop, dated February 15th, 1911, to secure £120. Holder: E. Bond, 43, Thurloe Square, S.W.

Premier Electric Control, Ltd. (98,772).—Debenture dated February 1st, 1911, to secure £2,800 and 7 per cent. interest, charged on the company's undertaking and property, present and future, including book debts and uncalled capital. Holder: P. D. Hamilton, 6, Queen's Gate Gardens, S.W.

Morris-Hawkins, Ltd. (93,821).—A memorandum of satisfaction in full on January 4th, 1911, of charge dated September 3rd, 1908, securing £1,500, has been filed.

Hilo Manufacturing Co., Ltd.—Particulars of £2,000 debentures, created February 13th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's undertaking and property, present and future, including uncalled or unpaid capital. No trustees.

CITY NOTES.

Notting Hill Electric Lighting Co., Ltd.

On March 7th, at Winchester House, E.C., Sir William Crookes, O.M., F.R.S., presided over separate meetings of the holders of ordinary preference, ordinary, and founders' shares of the above company to consider a proposed scheme of arrangement for the reorganisation of the capital.

Addressing the holders of the ordinary preference shares, the Chairman explained that the meeting was held to comply with an order of the High Court which required the sanction of three-fourths of the holders of such shares to pass the scheme. He might say that the scheme was promoted with a view to bringing the capital into line with that of neighbouring electric lighting companies and thus facilitate amalgamation which had been contemplated by recent Acts of Parliament affecting the electric lighting of London. The directors were of opinion that amalgamation would effect considerable saving in many directions, and thus enable increased dividends to be paid to the shareholders. The scheme had had very careful consideration, and the board considered it to be a most equitable arrangement for all classes of shareholders. It retained all the existing rights of the founders' shares without in any way taking anything from any of the other shareholders; and it would at the same time by turning the shares into ordinary shares bring the capital of the company on a par with that of the neighbouring companies, and would assist materially in promoting a scheme of amalgamation. In conclusion, he moved a resolution approving of the scheme.

Sir R. B. Martin, Bt., seconded the motion.

Mr. T. M. Poland said it seemed to him that the holders of the founders' shares were placed in rather an unfair position. Some years ago a meeting of the holders of those shares was held, when, in his opinion, the interests of the founders were snubbed by the board. They were asked to enter into an arrangement for the benefit of the ordinary and preference shareholders, without receiving any *quid pro quo* for what they had suffered in the past.

Mr. A. E. Franklin, J.P., explained that the founders' shares were originally £10 shares and they were subscribed for in full, and it was agreed at the time that the money should be used for the initial work. They were to waive any dividends on their capital, receiving instead half of all dividends after the other shares had received 6 per cent. There was a suggestion for dealing with these shares some time ago, but as some of the holders objected, nothing was done in the matter. There was no question of their having been badly treated. They were entitled to half the profits after 6 per cent., and they had received every penny to which they were entitled. He might say that the founders' shareholders by an overwhelming majority had by proxy approved of the scheme. It really left them where they were before. In the present condition of their capital it was impossible to develop on the lines which their Act of 1908 authorised them to develop upon. Their capital was different in arrangement to that of any other company, and arrangements for amalgamation which might be desired could not take place. The board consisted of some of the largest holders of founders' shares and also of ordinary shares, and therefore they had a right to consider themselves in a position of being able to hold the balance evenly as between the different classes of holders. The proxies received by the board represented the 75 per cent. which the Court required to sanction the scheme.

The resolution was then adopted unanimously, and subsequently, separate meetings of the ordinary and founders' shareholders agreed to a similar resolution.

The annual meeting was then held, Sir William Crookes again presiding.

The Chairman, in proposing the adoption of the report, said he wished to congratulate the shareholders upon having passed the scheme for the rearrangement of the capital—a scheme which, in the opinion of the directors, would benefit all classes of shareholders. It had only been put forward after most careful consideration, and he hoped the directors' policy would be justified by the increased dividends which, he trusted, would be paid in the future. As to the report and accounts, the directors had no regrets in submitting them to the shareholders, as, he believed, they were in every respect satisfactory. The net capital expenditure during the year was only £1,880, and was represented almost wholly by the £1,748 spent on mains—an expenditure which was absolutely necessary in order to connect up new customers. The revenue was the most satisfactory that it had been his privilege to present since the formation of the company 23 years ago. Compared with the previous year it showed an increase of £1,200, and in the profit there was almost a similar increase. It showed that economies must have been exercised on the part of the staff in order to have turned the whole of the extra revenue into extra profit, and their thanks were greatly due to the staff for bringing about such a satisfactory result. They had spent £135 in appealing against an increase in their rating assessment. They succeeded in getting nearly 70 per cent. of the increase taken off, but the directors did not feel justified in incurring the expenses which would be involved in carrying the appeal further. If, however, local authorities attempted seriously to overburden the company with rates it would become their duty to prosecute appeals to the higher courts. The net revenue account showed that there was a balance of profit to be divided among the shareholders, after providing for depreciation, renewals, &c., of £12,905, compared with £11,608 for the previous year. A further £3,000 had been added to the depreciation, renewal and reserve account out of the profits, the same as in 1909, and after allowing for the loss on the sale of old metal, there remained a balance to meet future renewals and depreciation of nearly £35,000. The Kensington and Notting Hill joint debenture stock sinking fund increased year by year. It was calculated on a 3 per cent. basis, but as the fund was being invested at a rate nearer 4 per cent., it should show a handsome balance in their favour at the end of the period. The houses connected last year numbered 232, and formed the largest addition for many years, and the dividend of 8 per cent. was a record in the history of the company. They had intended to deduct from the dividend the 1s. to be paid in respect of the new ordinary shares. To do this, however, would only be possible if all the shareholders had been unanimous, and as some few shareholders preferred to receive the dividend in full and then pay afterwards, that course would have to be done by all. The company's future prospects were, he was glad to say, bright The increase in the revenue had been maintained for the past two months, and the expenses remained almost stationary, so they would still continue to receive the benefit of the economies which had been effected in the past.

Mr. A. E. Franklin seconded the motion.

Replying to questions, the Chairman said there was nothing before the board at present in regard to amalgamation. They could not even attempt to discuss the matter until their scheme for the re-arrangement of the capital had gone through.

Mr. Makins said he noticed that in the report the board called attention to the fact that the London Electric Supply Bill which was passed last year, enabled the L.C.C. to purchase the company's undertaking. He wished to know whether that measure made any alteration in the status of the company.

The Solicitor explained that the Bill made no alteration in the terms of purchase—it simply substituted the L.C.C. as the purchasing authority in place of the local authorities. The same arrangement applied to all the other companies.

The report was adopted.

Salisbury Electric Light and Supply Co., Ltd.

The directors' report for the year ended December 31st, 1910, states that the generating plant has been sufficient to meet the output, and the whole of the plant is in thorough working order and capable of dealing with a considerably increased demand. The profit on the year's working, including £283 brought forward, amounts to £6,256, and after paying £1,431 interest on debentures and an interim dividend at the rate of 4 per cent. for the half-year, amounting to £700, there remains a balance of £4,125. The directors recommend that a further dividend at the rate of 8 per cent. for the half-year be paid, making, with the interim dividend, 6 per cent. for the year, and that £2,400 be carried to reserve, leaving £325 to be carried forward.

The dividend for the past six years has been only 5½ per cent., so that there is a move in the right direction.

	Units generated.	Units sold.	Total maximum supply demanded.
1908	617,495	513,046	314 kw.
1909	630,618	524,043	332 ,,
1910	651,548	540,158	321 ,,

Melton Mowbray Electric Light Co., Ltd.—Mr. W. J. New presided at the annual meeting of this company on March 9th. The eleventh annual report stated that satisfactory progress had been made by the company during the year, the lamps connected having increased from 18,074 to 19,889, being an increase of 10 per cent. The total number of consumers was now 580. The revenue for the year, after adding £45 brought forward, amounted to £2,260, and after providing for £1,000 debenture interest, there remained a balance of £1,260 available for distribution. The directors recommended that a dividend be declared at the rate of 2½ per cent. per annum, which would require £500; that £700 be placed to reserve for renewal of plant, and the balance (£60) carried forward. The chairman, in moving the adoption of the report, mentioned that the company's record year by year had shown very steady progress. The gross revenue had increased in 10 years from £849 to £3,615, the net revenue from £256 to £2,147 and the number of consumers from 78 to 580.—Mr. J. C. Wigham seconded, and the report was adopted.

Madras Electric Tramways (1904), Ltd. — The directors have declared a dividend of 2 per cent. (2s. per share) on the deferred ordinary shares for the year to December 31st, and 2½ per cent., in addition to 1 per cent., out of the surplus profits, on the preferred ordinary shares, making 5½ per cent. for the year.

Rosario Electric Co., Ltd.—An extraordinary general meeting of the shareholders of this company was held on Monday at the offices, 52, Moorgate Street, when a resolution was passed on the motion of the chairman, Mr. W. T. Weston, and seconded by Col. Lee, "That the company be wound up voluntarily." A confirmatory meeting will be held on March 28th, at which Mr. H. E. Benthall will be proposed as liquidator for the purposes of the winding up.

Harrow Electric Light and Power Co., Ltd.

THE directors report that during the past year 86 new consumers, representing 3,308 additional lamps, have been connected. The number of consumers at the end of the year totalled 1,309, their demands representing 39,684 lamps. The output of energy, notwithstanding the continued influence of the metal-filament lamps, shows a favourable increase, 421,561 units having been sold to the consumers, as against the 410,276 units sold in 1909; £4,550 of the new 4½ per cent. debentures has been taken up during the year. This leaves a balance of £1,400 still available for issue, which it is proposed to reserve for the shareholders, debenture-holders and consumers of the company.

The balance to the credit of the net revenue account, after deducting debenture interest and the interim dividend on the preference shares, is £2,501. The final dividend on the preference shares requires £375; a dividend on the ordinary shares at the rate of 5 per cent. per annum will absorb £1,667, and there is a balance to be carried forward of £459.

The directors have deemed it prudent to set aside out of the year's profits £2,500 for depreciation purposes.

An application has been made to the Board of Trade for a Provisional Order to extend the area of supply by embodying the urban district of Wealdstone and the parish of Pinner, and the necessary steps are now being taken in connection therewith.

The annual meeting was held on February 23rd, Mr. G. W. Spencer Hawes presiding. The CHAIRMAN said that the business had maintained a steady rate of progress, and after providing the customary dividends they had a larger carry forward. For six years in succession they had earned 5 per cent. ordinary dividend, and in that period £12,650 had been placed to depreciation and renewals. They had deemed it prudent to strengthen the annual provision for these purposes. The working expenses at 2·33d. per unit were the lowest yet recorded, the most notable economy being effected in the coal bill which was now only ·53d. per unit. The economies were largely due to the new plant at the generating station. Owing to the success of the use of the new boiler and mechanical stokers, they had equipped two of the old boilers with similar stoking apparatus. A striking feature of the year was the increase of the slot meter business which alone accounted for more than half of the additional sales. That class of supply was proving highly popular amongst the smaller consumers. The metal lamp had reduced the bills of many consumers. The demand for heating, cooking, &c., was gradually developing. The wiring department had had a busy year, though handicapped for want of more central premises. As soon as a suitable site could be secured, a central showroom would be fitted up, and in the same premises they would establish new offices. In referring to the proposed extension of their business to Wealdstone and Pinner, the chairman alluded to their friendly relations with local authorities.

The report was adopted.

Hove Electric Lighting Co., Ltd.

THE directors' report for the year ended December 31st, 1910, gives the following table of progress:—

Year.	Houses.	8-c.p. lamps.	Units sold.	Gross revenue.	Net revenue.
1908	1,676	114,135	1,134,994	£24,695	£13,463
1909	1,820	122,946	1,192,508	25,205	13,981
1910	1,949	129,217	1,178,165	25,991	15,400

There is an increase in gross revenue of £786 and a reduction in working costs of £633, the net result of the year's working being a profit of £15,400, compared with £13,981 in the preceding year. With the addition of £363 brought forward from 1909, the amount carried to the net revenue account is £15,764 (compared with £14,273 in the previous year), from which must be deducted the dividend on the preference shares paid September 1st, 1910 (£588), the interim dividend on the ordinary shares at the rate of 8 per cent. per annum (£2,825), a provision for debenture interest accrued, and income-tax, leaving a surplus of £9,836 now available. The directors propose to place £1,500 to the renewals and depreciation account and £3,000 to the sinking fund, to set aside £588 for accrued preference dividend to December 31st last, and to declare a final dividend on the ordinary shares, payable on April 15th next, at the rate of 10 per cent. per annum, making 9 per cent. for the year. The amount carried forward, after providing for the directors' extra remuneration of £354, is £862. The renewals and depreciation account, with the addition above mentioned, will now stand at £24,104. The sinking fund account, with the above addition of £3,000 and £1,313 received by way of dividends on investments, will now amount to £39,158. The machinery, buildings and mains of the company have been kept in good repair. The expenditure during the year on capital account has amounted to £2,326, the greater portion of which has been incurred in extensions of mains, in additional meters, and in the purchase of an additional generating set.

The annual meeting was held on March 9th, at Salisbury House, E.C., Mr. Carleton F. Tufnell presiding.

In proposing the adoption of the above report, the CHAIRMAN said that the number of houses on the system at the end of the year was 1,949, an increase of 129. The lamps and motors connected showed an increase of 6,271 over the year 1909, as compared with an increase of 8,811 and 6,169 respectively in the two previous years. Units sold had amounted to 1,178,165. This was the first occasion on which they had shown a reduction in the sale of current compared with the sale during the preceding year. The reason for the reduction last year was that they no longer supplied the Omnibus Co. with current for their electric 'buses. This supply was made at a very low price, and although they had not sold as many units in 1910 as in 1909, they actually received a larger price all round per unit, and the gross revenue showed an increase of £786. Seeing that on the other side they had a saving in total expenditure for the year of £633, the net result of the year's working showed a profit of £15,400, compared with a profit of £13,981 in the preceding year, and £13,463 in 1908. This, was most satisfactory, and was due, in a large measure, to the excellent work done by their engineer, Mr. C. B. Smith, and his staff at Hove. They proposed to add £1,500 to the renewals and depreciation account, bringing that account up to £24,104; £3,000 to sinking fund (as against £2,500 the year before) which would bring this fund up to £39,158. They proposed to declare a final dividend on the ordinary shares at the rate of 10 per cent. per annum, making 9 per cent. for the year, ½ per cent. more than they paid last year. He was sorry to tell them that there were still, on December 31st, 1910, as many as 247 houses, representing about 8,150 8-c.p. lamps, disconnected from the mains, and at the same time there were 30 consumers still on the old 110-volt supply. These had not come over to the 220-volt supply, notwithstanding the generous offer made by the company, and their reluctance was much to be regretted. At the last meeting he mentioned the effect of the introduction of metallic-filament lamps, and expressed the fear that they had still not reached rock bottom in this direction. This loss of revenue was fast righting itself, and he thought the present accounts showed that the more liberal use of electric light, induced by the cheapness of the supply, now proved what he then contended, that the introduction of the new form of lamp had very materially assisted electric light in its competition with gas. All the plant, machinery and mains had been carefully kept in good repair; where necessary, the plant and machinery had been overhauled, and everything appeared to be maintained in a satisfactory condition.

COL. H. WOOD, C.B., seconded the motion.

Replying to MR. WALFORD, the CHAIRMAN said he was glad to say that the increase of house connections had been more than maintained in the three months of the current year.

The report was adopted.

Lancashire United Tramways, Ltd.

MR. J. M. HENDERSON, M.P., presided on Tuesday last week at Winchester House, E.C., over the meeting of the above company.

The CHAIRMAN said, in proposing the adoption of the report and accounts, that he regretted the result had not been more satisfactory. The profit amounted to £13,688, and after paying the prior lien debenture stock interest they had carried £1,188 to the depreciation account, which had now been increased to £6,064. On the combined undertaking the receipts had increased by £777, of which £489 was from traffic receipts and £260 from the sale of energy to outside consumers. The passenger receipts had again been affected by the unsatisfactory condition of the cotton industry. That trade, however, appeared to be taking a turn for the better, and as their business lay wholly in the cotton manufacturing districts, they must benefit materially from any prosperity in that trade. They were getting an increasing number of power consumers. This branch of their business was remunerative, and their accounts in the future would undoubtedly show a further increase of revenue from this source. The increase in the expenditure included £660, which they lost through the failure of the Law, Car and General Insurance Corporation, who held the whole of their public liability risk. They had now made arrangements to deal with the smaller claims themselves, and had effected an insurance against large accidents only. From their experience since the system had been in operation, they thought this method of insurance would prove more economical. Their track, owing to a subsidence from colliery working, had this year necessitated an increase of £847 on reinstatement, and they had also been obliged to incur an expenditure of £330 in reconstructing eight cars. The other principal item of increase was for managing their own advertisements on cars, which was due to the fact that the accounts bore the cost of managing this department for a whole year, as compared with a portion of 1909. Their accounts for the current year showed an increase in the revenue from this item, with a decrease in the cost of management. Seeing that they had written off a great portion of the cost of advertising plates, their working expenses were still very low, amounting to 5·65d. per car-mile, which included the free lighting of the streets through which the tramways ran. Their cost per car-mile remained one of the lowest in the kingdom, and was kept at as low a figure as was possible with efficiency, and it was to an extension of their receipts that they must look to increase their revenue, and with improved trade conditions, they hoped to show much more favourable results for the current year. They regretted to record the death of Mr. J. R. Salter, the company's general manager, who had been associated with the company since its inception. Mr. E. H. Edwards, who had been his assistant for some years, had been appointed to fill the vacancy.

MR. A. ADAM seconded the motion.

MR. KAHN pointed out that in 1909 the sale of current went up about £900, and the cost of generation decreased by £500. Last year the sale of current had gone down by £1,100, whilst the cost of generating was £30 or £40 more.

The CHAIRMAN said the explanation was that the sale was

regulated by the receipts from the tramways. Next year they hoped to leave out the tramways altogether in connection with the item, which would then refer only to outside consumers. The tramway company was a statutory company, and although they held the shares still, it was not actually merged, and they were obliged to charge the company for the supply of current, and that charge was varied according to the traffic receipts.

Mr. Kahn said he took it they did not charge the company for the exact number of units they really took.

The Chairman said they charged the units, but altered the price according to the traffic receipts.

The motion was carried.

W. T. Henley's Telegraph Works Co., Ltd.

The meeting of this company was held on Friday last, at the offices, Blomfield Street, E.C., under the presidency of Mr. Sydney Gedge, M.A., who, in proposing the adoption of the report (see Elec. Rev., page 395), remarked that that was the twenty-fifth occasion on which he had had the pleasure of presiding over their annual meeting. He well remembered the first meeting, held on December 31st—they put it off as late as they could in the hope that there might be good news to communicate to the shareholders, and it was also held on that day in the hope that very few shareholders might be present, because the directors did not wish to have to answer disagreeable questions. There was no need now to postpone the meeting until the last day in the year; indeed he had to apologise that it had not been held in February. The delay had been caused, not because they wished to keep back bad news, but because the multiplication of the company's agencies and business all over the world had rendered it difficult to get the accounts made out and audited sooner than they had been. Having referred to the loss the company had sustained in the death of Mr. B. T. Finch, a director in whose place Mr. Martin Roberts had been elected, the chairman said he regretted Mr. Roberts was not with them, but very important business connected with the telegraphs had taken him to the Far East, where he thought he saw his way to also do business for the company. The directors were proposing the same dividend as had been paid for many years—15 per cent., free of income-tax. The figures in the balance-sheet were very much the same as in former years. In the profit and loss account they would see that they had put aside for depreciation on buildings, plant and machinery out of profits, a sum of £17,244, which was the largest sum they had ever put aside for that purpose. Last year it was only half as much. During the past 20 years they had put aside over £100,000 for depreciation, and having regard to the fact that the item of freehold buildings, plant, machinery, &c., stood in the assets at under £400,000, he thought they would agree that the board had made a very good reserve. He would like to say a word respecting the item of £8,777 reserve under cable repairing contract, invested in the joint names of trustees for the company and the Crown Agent for the Colonies. That cable was laid in the spring of 1892, and they had guaranteed the keeping of it in repair to the extent of the reserve fund for a period of 20 years. Those 20 years would expire in the course of another 12 months. They received £700 a year from the Government of the Bahamas for the purpose of making a reserve fund against which those repairs should be charged. When the fund exceeded £6,000, the £700 a year was to be divided—half was to be invested and the other half was to go into the coffers of the company, and they were getting that money now. As he had said, there was a balance of £8,776, and while he did not wish to prophesy, he thought they had very good reason to hope that there would be a very small claim upon the fund during this year. The balance remaining would be divided equally between the company and the Government of the Bahamas next year, and at its present figure their share would be about £4,500. He was afraid, however, that they would not get quite as much as that, because the fund was invested in securities which were purchased when they were much higher in price than they were now. With regard to their investments, where they were shares in other companies, they had written them down very considerably. £125,000 was invested in what used to be called gilt-edged securities—Consols and other trustee securities—and to meet any loss on them they had been written down by £6,394 out of profits. He was glad to say that if the value of those securities were taken to-day, it would be found that they had appreciated to the extent of about £2,000, so they really need only have written them down by £4,000. They would be asked to increase the remuneration of the directors. It might occasion some surprise, perhaps, that he, as chairman, intended to propose that increase instead of getting a shareholder to do it. The fact was that the matter had been discussed by the board, and they felt from their knowledge of the work they performed, that it was best for them to come forward boldly and propose the increase themselves. He believed the shareholders would agree to the proposal, but he wished to make it plain that the board had not asked for a single proxy. They had considered the remuneration which was paid in other companies, and had come to the conclusion that for many years they had been working very cheaply, and now that the company was not only on its legs, but running a steady pace, they thought they were entitled to a larger remuneration. For the last 12 years the ordinary shareholders had received a 15 per cent. dividend and in three of those years they had paid 20 per cent. Indeed, as far as profits were concerned, they could have paid 20 per cent. all along, but the board had always had the support of the shareholders in the prudent course of only paying 15 per cent. so as to be able to present a strong balance-sheet. Under the present articles the directors received £1,000, and they proposed to ask the meeting to increase the amount to £2,500. He wished to say, in conclusion, that last year, as indeed for many years past, they had received every possible assistance from the managing director, from Mr. Salmon, the secretary, from Mr. Hatton, the engineer, and Mr. Potter at the works, and the business had been very satisfactory. There had been no trouble with the workmen, and no serious accident. The Gravesend works had now turned the corner, and was earning its share of the dividend.

Mr. G. Sutton, managing director, in seconding the motion, said that an investigation into the trading of last year would show that it was altogether different from any year that had preceded it. As they would remember, the year witnessed the great rubber boom, and rubber was, perhaps, the most important article which the company had to deal with in relation to its manufactures. The steady course which had always been adopted by the company of not overstocking material of any kind, and of keeping its stocks of manufactured articles down as low as possible when markets were ruling high had been their security, and he was glad to think that he could say that they had not lost any money owing to the high prices of rubber. Another very important feature of the year's trading was the volume of business, which had been by a long way the largest that the company had ever known. That volume had produced a lower percentage of profit, but the net result was a profit of some few thousands more than the previous year. Although the home trade had been satisfactory, it was in the foreign trade that they had made the large increase in their volume of business. The home trade had been fairly satisfactory in regard to india-rubber wires and cables — their staple goods, which showed a considerably increased turnover. The total of the home trade, however, had not increased, because contracts in this country for tramway enterprises, &c., had been conspicuous by their absence. The Colonial and foreign trade in all parts of the world had immensely increased. One very satisfactory side of that business was that they had done the largest trade on the telegraph side of their cable making that they had done for the last 20 years, and it had yielded them very fair profits. The money spent last year on plant and buildings was principally expended in enlarging the Woolwich works. They spent £24,000 last year, and before those works were completed they would have to spend another like amount. They decided to replace several of their machines, and so last year they scrapped a good deal of machinery. It was 30 years ago since an inventory of their machinery was taken, and they thought that last year was an opportune time to make another one. They employed their own staff on the work, and they had produced a volume which would be of great value to the company, for it recorded every bit of plant in the North Woolwich works, the cost and the valuation. At any time they wanted to scrap a piece of machinery they could turn up that book and see at a glance what it cost and what it was represented at in the balance-sheet. With regard to the Gravesend works, they turned the corner in 1907. They were opened in the middle of 1906, and for the first year's working paid for the capital which was expended. Gravesend had been one of the best undertakings the company had ventured upon. The turnover at those works last year was 50 per cent. above that of 1909, which would prove that the policy of the board in spending such a large sum of money as they had in establishing those works was a right one.

The report was adopted.

The Chairman then formally moved a resolution increasing the remuneration of the directors from £1,000 to £2,250, as from January 1st this year.

Mr. F. Smith seconded the resolution, which was carried unanimously.

County of London Electric Supply Co., Ltd.

Mr. J. B. Braithwaite (chairman) presided on Monday at Winchester House, E.C., over the meeting of this company.

In moving the adoption of the report (see Elec. Rev., page 395), the Chairman said in the history of the past year there were no special features of any kind. There was no change in the capital account, and the capital they had required during the year had been obtained by the sale of a further portion of their unissued debenture stock and a slight increase in the loans from the bankers. In the revenue account they had a very satisfactory state of affairs, inasmuch as their company came out the best of all the London companies in the amount of its increase in the gross revenue. Last year he said he thought that they had seen the worst of the depletion of their revenue caused by the change from the carbon to the metallic-filament lamp, and the fact that their revenue showed the substantial increase of £8,684 proved that that view was a correct one. If any further confirmation were wanted, it was forthcoming in the fact that the units sold this year on both the north and south side of the river had increased by 5·6 per cent. He had told them before that the directors believed the introduction of the metallic-filament lamp would be useful rather than otherwise, for anything which tended to make electricity cheap was in the interest of the industry at large, and therefore, notwithstanding the temporary decrease in revenue, they were of opinion, and still were, that the metallic-filament lamp was going to do great things for the industry. Their gross revenue showed an increase of 5·7 per cent. after deducting allowances for bad and doubtful debts. On the other hand, they had had some slight increases in their working expenses. They had had to pay rather more for coal, and there were other things which reduced the net balance by a considerable amount. To put the thing in a nutshell, the net result was that they paid the same dividend as last year, placed £20,000 to depreciation instead of £16,000, and carried forward £1,372, which was a very satisfactory increase under the

circumstances. They were very anxious to increase the amount put to the depreciation fund, and he hoped the current year would enable them to make a further substantial addition in that direction. With regard to the companies in which they were interested, last year he told them they were making satisfactory progress at Coatbridge, and this had been continued. They had had an increase of £648 in revenue and a very considerable increase in the number of units sold, and that appeared likely to continue. The Bournemouth company had paid the same dividend as last year. In their own case the increase in units sold was, approximately, 2½ millions, the great bulk of which was for power, and they were still holding their position as, perhaps, the leading London electric supply company for the supply of power, and he hoped that source of revenue was going to continue for a considerable time to come. Their lamp connections during the year were an absolute record. They had had good connections in previous years, but this year was the very best they had ever had, and on the old method of reckoning, it would be equivalent to over 125,000 lamps of 35 watts each. So in all the essential points, the board had nothing but a good story to tell them. They had had a satisfactory year from the gross revenue point of view; a very satisfactory year from the net revenue point; a record year in the number of lamps connected; and the working expenses showed a further decrease in the cost per unit. The relation of the expenses to receipts was 40·6, against 41·54 or a decrease of nearly 1 per cent. They had opened the current year extremely well with a large increase in the sale of current, and there was every prospect of the year being the best they had had for a long time, and he quite anticipated a further increase in the profits. The actual increase last year in lamps was 17 per cent. over 1909, which was in itself a record, so that the progress of the business seemed to be going on in an accelerated manner. They had 1,760 new customers, and their total customers were 16,883. He had told them last year that they hoped to get their northern and southern stations connected under the London Electric Supply Act of 1908. That was not yet an accomplished fact, for there had been considerable delays in getting the consents required from the various bodies. Their solicitor told him that morning that the agreements were now practically settled, and so he took it that when they met next year the stations would be connected, which would result in increased safety and economy. The Joint Publicity Committee formed by the various London electric supply companies had done very great service in the past year in organising the publication of suitable literature and in canvassing for the companies generally, and one result was reflected in the satisfactory growth of their business. The only other matter they would expect him to say a word about was the extraordinary state of things which existed at the present moment in the borough of Holborn with regard to the lighting of the borough. The Council invited tenders from the gas and electric lighting companies, and when the tenders were opened it was found that those of the electric light companies, of whom they were one, would mean to the borough a saving of something like £9,250 over a period of 10 years, with a very largely increased candle-power. As business men they might have supposed that there would be nothing to do but to accept the electric lighting companies' tenders, but the Borough Council did not do things in this way, and they brought up a recommendation that the gas company's tender should be accepted. Naturally, the ratepayers made some disturbance, and he believed now they were going to invite fresh tenders. What the advantage of that would be he failed to see, but they could depend upon it that if the Council was determined to sell the borough to the gas company at the expense of the ratepayers the public would be made acquainted with the manner in which their interests were served by that Council.

MR. J. SHAW, K.C., seconded the motion.

MR. MAKINS asked whether the 1908 Act had been of any service as yet to the company in the way of linking up with other companies. He understood that this was the object of it, so as to save capital expenditure. He thought if something could be done in this way, it would be better for the shareholders when the County Council came to purchase the undertakings, and the shareholders looked for the return of their capital. They were told that some of the companies would very much like to link up, but the progress seemed rather slow.

MR. LIGHTON congratulated the board on the progress made, and said he was glad to see that reserve stood at £82,000. He would like to see the preliminary expenses reduced.

The CHAIRMAN said he was not altogether surprised at the feeling of impatience to see some result from the Act of 1908, but they had to remember that negotiations between companies and local authorities, and also between the companies themselves, necessarily involved a great deal of time. He could assure them, however, that the Act was by no means a dead letter. The companies and the local authorities with electrical undertakings had been considering the best means of putting that into operation, and it was better to wait two or three years, and carry out a well-thought-out system of linking up, rather than do it on patchwork lines which would afterwards have to be altered. A strong Committee of the companies and the local authorities had been formed, and a Committee of Engineers was at the present moment engaged in drawing up a comprehensive scheme for linking up. He expected they would have to go to Parliament for some further powers in one or two directions, but that would be after they had formed some definite scheme.

The motion was carried, and the retiring directors were re-elected.

The CHAIRMAN subsequently moved a resolution increasing the company's borrowing powers by £200,000. He explained that they had at present borrowing powers of £1,000,000, but these would be exhausted during the present year, and the additional powers were required to cover an overdraft at the bank. They could not issue any more debenture stock, and he took it that their next issue would be of ordinary shares when the market was favourable.

MR. SELLON seconded the motion, and it was carried.

South London Electric Supply Corporation, Ltd.

THE directors' report for the year ended December 31st, 1910, states that the gross receipts for the year were £41,159, while expenditure was £17,689, leaving a profit balance of £23,469, plus £1,125 brought forward. There is thus a total amount available of £24,594, and after providing for depreciation on plant and machinery (£5,000), debenture and other interest accrued, &c., there is carried to the general balance-sheet £14,002. Out of this the board recommend the payment of a dividend at the rate of 5 per cent. per annum on the ordinary shares, amounting to £13,000, carrying forward £1,002. At the end of 1910 there were connected to the company's mains the equivalent of 232,179 (35-watt) lamps, showing a net increase for the year of 21,785 upon last year's figures. Applications were also in hand for a further 6,200 (35-watt) lamps not then connected to the circuit. During the year under review the plant, machinery and mains have been maintained out of revenue in a high state of efficiency. The revenue of the company is increasing steadily. The units sold during the year, which amount to 4,101,539, show an increase of 396,331, or 10·7 per cent. in excess of the previous year, the total cost per unit sold being 1·04d. as against 1·18d. in 1909, a reduction of 12 per cent. This reduction is largely owing to the installation of the turbine plant. The ratio of total costs to revenue is 43 per cent.

Units generated	5,160,180
Sold to consumers and used by public arc lamps	4,101,539
Used on works	312,000
Total	4,413,639
Expended in distribution	746,641
Total connections in KW.	8,126

Greenock and Port Glasgow Tramways Co.

THE directors report that the total expenditure to December 31st last on construction account amounted to £193,757. The total revenue for the year amounted to £32,519, an increase of £3,079. After deducting all expenses chargeable to revenue, including interest, payments to Corporations, and the provision of £2,250 for renewals account, there is a surplus of £8,780, as compared with £6,765. Adding £666 brought forward, there is available £9,446, as against £7,085. There is to be placed to reserve sinking fund for loan redemption, £1,770; to depreciation and reserve account, £650; to dividend at the rate of 5 per cent. per annum on the preference shares, £3,500; dividend at the rate of 3 per cent. per annum on the ordinary shares will require £3,450; and £76 is to be carried forward. In consequence of the better trade conditions experienced prior to September, the traffic receipts have increased by over 10 per cent., which result would have been exceeded but for the unfortunate labour dispute, which started in September and lasted for 14 weeks. Mr. W. G. Bond has resigned his seat on the board, and Mr. W. L. Madgen has been elected a director and chairman.

	Year ended Dec. 31st, 1909.	Year ended Dec. 31st, 1910.
Miles Open—Route miles	7·42	7·42
Single line	·81	·81
Double line	6·61	6·61
Passengers carried	6,349,638	7,278,253
Average receipts per passenger	1·08d.	1·04d.
Average working expenditure per passenger	·63d.	·59d.
Proportion of working expenses to receipts	57·6%	56·7%
Cars working	40	40

Companies Struck off the Register.—The following companies have been struck off the register, and are accordingly dissolved:—

Anglo-American Aluminium Co., Ltd.
British Electric Equipment Co., Ltd.
Economic Boiler Co., Ltd.
Economic Smoke Consumer, Ltd.
Gas Traction Co., Ltd.
Mercedes Electric Manufacturing Co., Ltd.
Missenden and District Electric Light and Power Co., Ltd.
National Automatic Light Controller (Sparks' Patent) Co., Ltd.
Sir Hiram Maxim Electrical and Engineering Co., Ltd.
Société Anonyme des Accumulateurs A.C.S. (Système de Sedneff), Ltd.
Switch Electric Lamps, Ltd.
Telescriptor Syndicate, Ltd.
Traction Batteries, Ltd.
Vaughan & Brown, Ltd.
Zirconium, Ltd.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

London Electric Railway Co.—Script fully and partly paid for £1,250,000 4 per cent. preference stock.

Shawinigan Water and Power Co.—Further issue of $1,500,000 capital stock in shares of $100 each.

And to allow the following securities to be quoted in the Official List:—

Bombay Electric Supply and Tramways Co., Ltd.—Further issue of £20,000 second mortgage debentures of £100 each.

South Metropolitan Electric Light and Power Co., Ltd.—The debenture stock register and register of transfers will be closed from March 18th to 31st, for preparation of warrants for the half-year's interest, payable April 1st.

Metropolitan Electric Supply Co., Ltd.

THE meeting of this company was held on Tuesday at Winchester House, E.C., Mr. W. Harrison Cripps presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 397), said that at the end of 1909 the capital expenditure amounted to £1,898,000. At the end of 1910 they had spent £1,936,000, or an increase of £38,000. They obtained £15,000 of that money from the sale of the remainder of the 4½ per cent. debenture stock, which completed the full issue of that stock, the remainder being taken as a loan from the reserve fund. The money was spent, broadly speaking, in the ordinary development of the business, but chiefly in the special development of Hanwell and Southall, their new districts, which at present had not begun to return any revenue in exchange for that expenditure. The gross revenue for current was £172,438 as against £174,116 for 1909, so that there was a decrease of about £1,700. The working expenses in 1910 amounted to £78,282, compared with £79,847, a decrease of £1,600. Therefore the revenue was practically the same last year as in 1909, the slight decrease in the revenue being met by an almost corresponding decrease in the expenses of generating. That left them with a balance of £94,454. From that the directors proposed to set aside the usual amount of £15,000 for reserve, leaving a net revenue of £79,454. Adding to that the carry forward of last year, and the interest from their investments, they had a total of £91,661. From that they had to deduct the interest on the debentures and the preference shares and what had been paid for the loans, totalling together £44,390. The directors proposed to add £3,500 from the undistributed portion of the Marylebone purchase account which would make the balance at the credit of the net revenue account £50,771. In August they paid 2s. a share on the ordinary shares, which absorbed £20,000. They now proposed to distribute a further 3s. per share, making 5 per cent. for the year, the same as last year, which left the carry forward practically the same—between £700 and £800. If they came to look into their accounts and compared them with those of any other company, it would be found that they possessed an extremely satisfactory reserve fund. That fund now amounted to more than a quarter of a million. When they originally decided what was a fair and proper amount to set aside for a reserve to meet depreciation during their 42 years they arrived at a certain figure, but, as a matter of fact, the depreciation during the first 10 years as regarded plant and machinery, was naturally very much greater than it had been since. When they first started, a large amount of their machinery and plant was what one might almost describe as of an experimental nature, and the consequence was that inevitably after a certain number of years a considerable amount of it would have to be scrapped, and that was the position of very many of the other companies. In their case, however, they entirely got rid of Marylebone with the old plant and machinery, and they also had to sell their Sardinia Street site to the L.C.C. That contained practically all their old machinery, and the arbitrator gave them an award sufficient to replace the whole of the plant and buildings in a new and up-to-date form, and that was what they did. That was 10 years ago, and since then there had been very little depreciation, except in Paddington, where he was bound to say there had been very substantial depreciation. The machinery which they put up 10 years ago was running now in perfect order. It had been kept up to date, and they were not within visible sight of having to scrap any portion of it. Therefore their big reserve fund was not a provision against a lot of antiquated machinery, but machinery which was up to date. With regard to the decrease in the revenue that was undoubtedly largely due to the use of metal-filament lamps which commenced some two years ago. That diminution went on pretty rapidly, but he was glad to say it seemed to have culminated about a year ago. At first customers seemed willing to have the same amount of light and save the expense, but now they found that their individual customers were increasing their consumption. He hoped they had reached bottom in respect of the decrease. In the first quarter of last year their loss was the largest; the diminution in income being about £6,000. In the next quarter in place of a decrease there was a small rise; in the third quarter there was quite an obvious increase; in the last quarter there was a very substantial rise, and he was glad to say that that increase had continued to manifest itself during the past three months. As regarded works cost, through the great care of their engineering staff they had been able to reduce the price per unit still further to a small extent. One of the most unexpected reductions in their expenses last year was that they spent only £11,273 in rates, as against £12,123 in 1909. Those rates pressed very heavily upon a business like theirs, and it was a most unfair thing that they should have no voice whatever either in the raising or the spending of the money. He believed that it was the large increase in local rates that prevented many a manufacturing company from meeting foreign competition. The chief reduction in their rates was owing to the success of their Willesden appeal. They took the case to Quarter Sessions, and their assessment was reduced some thousands of pounds even below that which they had been willing to pay. They had other appeals going on in various parts of London, but, of course, he could not say how they would succeed. With regard to Acton, the Bill giving them power to supply that borough had passed second reading in the House of Commons, and was now referred to a private Committee. He had no doubt they would get a fair and proper hearing, and he did not think there was any reason why Parliament should not give its sanction to their taking over the Bill. Referring to the Bill promoted by the District Railway and the London Underground Electric Railway for the purchase of Lot's Road power house, he said that they stood in a different position from the other companies who opposed the Bill unitedly, as they had always looked to the supply of some of the big railways with power as being quite within their rights. Therefore they entered a separate opposition to the Bill, but he was pleased to say that the companies came to an agreement with them, the substance of which was that, instead of working in antagonism, they would all work together. He was one of those who believed in amalgamation as far as possible, as it not only would lead to economy, but the companies would be able to lessen their prices and would be able to make larger profits for the shareholders. The cable to supply Southall and Hanwell was now complete, and they were working upon a system which was entirely new to this country—the direct-current high-tension system. The great advantage was that they were able to lay a very small cable practically any distance. They commenced by supplying at 2,000 volts, which was quite sufficient for their purposes for the first year or two. As the district developed and fresh customers came on, they could increase the voltage up to 100,000, so that without spending another penny upon the cable, as the business grew, they would be able to multiply its capacity 50 times. He believed that would turn out to be the salvation of the company, as it would enable them to supply outside districts in a way they never could have done if they had had to go to the expense of the bigger cables.

SIR J. PENDER, Bart., seconded the motion.

The CHAIRMAN, replying to questions, said he did not think it prudent to say anything as to whether they had hopes of supplying large railway companies with power. He was pleased to say they were making a very substantial advance in their customers, but old consumers who used to pay them £15 now only paid £5, because they got so much more light with the new lamp. They were, however, getting just as large a proportion of new customers as ever. With regard to the street lighting of Holborn, they had had most delicate negotiations on that matter. There were three companies empowered to supply that district—the Metropolitan, the Charing Cross, and the County of London. They had put in a joint tender on behalf of the three companies in opposition to the gas company.

The report was adopted.

Oxford Electric Co., Ltd.

SIR HENRY C. MANCE presided on March 3rd at the annual meeting held at Oxford, and in moving the adoption of the report (see ELECTRICAL REVIEW, page 358), said that that was the nineteenth of their meetings at which he had been present, but during all those years of quiet steady progress, there had not been a time of greater anxiety than during the last two years, when they had been face to face with new lamps of marvellous efficiency, which in a great number of cases had reduced electric light bills by one-half. Their report for 1910, however, compared very favourably with the majority of the reports of electric lighting companies throughout the kingdom. They had added a large surface condenser and an automatic stoker with which they could burn coal from the Midlands, and so be to an extent independent of the supply of Welsh coal. They had increased their generation by 50,000 units, but the coal bill had decreased, though the price of coal averaged the same in both years. The income had increased notwithstanding the new lamps. They had added 8,000 30-watt lamps, but the lamps were not quite so remunerative as those they had added in past years; the customers were smaller consumers who used the light with remarkable economy. There was now a distinct improvement in business generally, and they hoped to get better results during 1911. For the Coronation they would give current at reduced rates, and would give any other assistance possible. In order to educate the public they had issued literature, and would issue more. In regard to the Oxford tramways, he thought there should be no difficulty in designing a standard which would be graceful and unobjectionable to the most fastidious. The only alternative to the overhead trolley was self-contained traction. That was much more expensive to run, but the capital expenditure was less, and he was surprised that a system which was so popular in America should be regarded with disfavour in this country. They did not require any new capital at present; that would depend largely upon the tramways, and the present quarter's working. If they decided on increasing the generating plant to meet next winter's load, they might require some additional capital; but it would be issued only at the end of the year.

The report was adopted.

Hadfield's Steel Foundry Co., Ltd.—The directors' report states that the state of trade during the year 1910 was not brisk either in Government or in ordinary work; but, notwithstanding this, the company fully maintained its position with satisfactory results. The directors recommend that in addition to the interim dividend of 1s. per share paid in August last on the ordinary shares, a further dividend be paid on the ordinary shares of 2s. per share, together with a bonus of 6d. per share (all free of income-tax), and to carry forward the balance of £33,280.

Mirrlees Watson Co., Ltd.—The report for the year to December 31st shows a net profit, including £1,678 brought down, of £45,652, out of which the directors recommend a dividend of 10 per cent., and a bonus of 5 per cent., as compared with a total distribution of 7½ per cent. for 1909. After transferring £16,000 to general reserve and £10,000 to new tools account, £1,996 is to be carried forward.

Winchester Electric Light and Power Co., Ltd.

THE directors, in their report for 1910, express regret at the death of their chairman, Mr. T. F. Kirby, who had held that position since the formation of the company. Mr. F. E. Gripper has been elected to the vacant post. The equivalent of 1,582 8-C.P. lamps have been added during the year, making the total connection 60,235 8-C.P. lamps. Including the balance of £297 brought forward, there is a net profit of £7,411, which, after payment of debenture interest, £2,050, leaves a balance of £5,361 available for distribution. An interim dividend for the half-year at the rate of 5 per cent. per annum, amounting to £1,105, was paid in September last, and the directors now recommend that a dividend at the rate of 7 per cent. per annum be declared for the half-year, which will absorb £1,547, making 6 per cent. for the year, leaving a balance of £2,709 to be carried forward. The agreement for the sale of the company's undertaking to the Corporation of Winchester has been sealed by both parties. The completion of the sale cannot take place until the special Act, which is being applied for by the Corporation, has been passed by Parliament. As soon as the sale has been completed a general meeting of the shareholders will be necessary to deal with the assets and approve the winding-up of the company.

Units generated		642,538
Quantity sold—Ordinary	411,406	
Prepayment	47,372	
Motors	56,277	
Total sold to private consumers by meter	515,055	
Used on works and loss in mains	108,940	
Total quantity accounted for		623,995
Quantity not accounted for		18,543
Total maximum supply demanded	428 KW.	

Brompton and Kensington Electricity Supply Co., Ltd.

FOR the year ended December 31st, 1910, the directors report that the revenue account shows a credit balance of £26,680, which, with the balance of £8,521 brought forward, and £905 balance of interest received and accrued, makes a total of £36,106. After deducting £1,671 for interim dividend on the 7 per cent. cumulative preference shares, and £6,851 interim dividend at the rate 9 per cent. per annum for the half-year to June 30th on the ordinary shares, the directors recommend that the sum remaining, viz., £27,583, be dealt with as follows: To credit of depreciation account (maintaining this fund at £80,000), £1,707; dividend on preference shares for half-year ended December 31st, £1,671; dividend on the ordinary shares for half-year ended December 31st, at the rate of 11 per cent per annum, making 10 per cent. for the year, £8,373; to credit of reserve fund account, £8,000; to directors' additional remuneration, £388; to be carried forward, £7,443. The following table shows the progress of the business:—

Year.	35-watt lamps connected.	Increase in lamps.	Customers connected.	Gross receipts. £	Expenditure. £	Net receipts. £	Aver. price per unit. d.	Div. on ord. shares.
1907	213,916	11,160	4,362	55,684	23,916	31,718	4·22	10%
1908	224,826	10,910	4,593	53,113	25,318	27,795	4·17	10%
1909	235,802	10,976	4,883	50,791	23,710	27,081	4·18	10%
1910	246,974	11,172	5,163	50,597	23,917	26,680	4·26	10%

Waste Heat and Gas Electrical Generating Stations, Ltd.

THE annual meeting was held on 7th inst., at Newcastle-on-Tyne. DR. J. G. SIMPSON, who presided, said, in moving the adoption of the report, that the issued share capital of the company was £10,000 more than at this time last year, and now amounted to £160,000. These 10,000 shares were issued to the Weardale Steel, Coal and Coke Co., Ltd., under the terms of the agreement with them, and had been paid for in full in cash. The capital expenditure on the generating stations owned by the company amounted to £138,523, which was an increase of £23,152 during the year. The Newport generating station has been extended, and the plant capacity now installed was 5,100 KW., all of which had been completed and paid for; the installation was proving advantageous to all parties, and was yielding an entirely satisfactory return on the capital which the company had expended. The third and smallest of their generating stations, which was at Tees Bridge, had not been in regular operation during the whole of the past year, but they expected to be able to take over the plant from the contractors at an early date, and the balance of the contract price for the station would therefore also be paid during the current year. The profits earned during the year showed an increase of £5,439 over the previous year. Their investment in the Bankfoot Power Co., Ltd., had yielded a return of 10 per cent., which had been included in the total profits. They had transferred a sum of £7,000 out of the profits to the reserve and depreciation account, and the amount standing to the credit of that account, including the sinking fund for the Weardale Coal Co.'s motor installation, now amounted to £13,473. The directors proposed to pay 8 per cent. for the year, as compared with 7 per cent. which they had paid in the two previous years. It was gratifying that they were able to propose an increase in the dividend, and to retain the satisfactory margin of £6,048 to be carried forward. Negotiations were proceeding for the erection of further generating stations. Two of these would be in the area of the Cleveland Power Co., one being for the utilisation of exhaust steam from the Port Clarence Iron Works of Messrs. Bell Bros., Ltd., and the other for the utilisation of exhaust steam from the Lackenby Iron Works of the Tees Furnace Co., Ltd. Satisfactory preliminary agreements had already been made with the power company in respect of those generating stations under which their company would receive a regular and remunerative return for the use of the generating plants, and a further profit on all the electricity which might be generated by using the waste heat which was available from the furnace owners. The directors had under consideration a third new agreement for the erection of another generating station, but negotiations had not reached the stage at which he could refer to this agreement more than in a general way. The directors hoped during the current year to make a further issue of capital to obtain the money which would be required for the new generating stations, but it was yet too early to say exactly when the issue would be made.

MR. NEWALL seconded the report, which was carried unanimously. The dividends were passed, and Mr. F. S. Newall was re-elected a director.

British Engine, Boiler and Electrical Insurance Co., Ltd.

WE are informed that at the thirty-third annual meeting of this company held at the head office at Manchester on March 3rd, the chairman (Mr. Longridge) stated that while the increase in business during the year 1910 had been highly satisfactory, there had also been a considerable increase in the item of claims as compared with the preceding year. There seemed to be no particular reason why the ratio of claims for steam engines and dynamos should have increased so much as it had done (in the case of dynamos the increase was nearly 25 per cent.), but it was somewhat remarkable that their heaviest losses had been on re-insurances for other companies, where the inspections were not undertaken by their own staff. Among electric motors (in which class of their business there was practically no re-insurance) the ratio of breakdown was almost identically the same as in previous years, viz.:—One breakdown for every eight motors insured. That breakdowns were so numerous, even among machines which were constantly under supervision, testified to the value of insurance such as the company undertook, and the steady increase in the business was sufficient proof that their work was appreciated. In regard to the oldest branch of their special class of business—the insurance of boilers—during the year there had been no explosion of any boiler under their inspection, and although one life had unfortunately been lost through the collapse of a furnace crown, that was the result of an oversight in regard to the feed, such as could not be prevented by any system of inspection that might be devised. The rate of increase in the number of boilers in use was not so great as in former years, owing to so many of the smaller boilers being superseded by gas or oil engines, or by electric motors, while in the case of large works it was a common practice to replace old boilers by a smaller number of boilers of larger size. With improved designs and better facilities for inspection there was greater safety in working now, even though the pressures were so much higher than in the days when boiler insurance was first started some 50 years ago. A dividend of 5s. per share, with a bonus of 2s. 6d., making with the interim dividend paid on July 1st, a total of 12s. per share for the year, was agreed to.

Direct Spanish Telegraph Co., Ltd.

THE directors' report for the year ended December 31st, 1910, after providing for interest on, and redemption of debentures, and for the dividend on the preference shares, a balance of £6,635. Out of this they recommend the payment of a final dividend for the half-year ended December 31st, 1910, at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares, amounting to £1,293. This, with the interim dividend paid on October 1st, 1910, makes a total distribution of 4 per cent. for the year. The remaining balance of £4,049 has been transferred to the reserve fund. The traffic receipts show an increase of £2,264, and the working expenses a slight decrease as compared with the year 1909. During the past year the Bilbao cable has been interrupted three times. On the first occasion a fault was removed by the cable steamer *Electra* at about 200 knots from Falmouth, and the cable was re-opened for traffic on May 15th, after two days' interruption. The second break occurred on July 3rd, 50 knots from Falmouth, and communication was restored by the cable steamer *John Pender*, on July 11th, after seven days' interruption. The cable became again interrupted on December 20th at about 11 knots from Falmouth, the necessary repairs being effected by the cable steamer *John Pender*, and the cable re-opened for traffic on December 30th, after an interruption of 10 days. The Marseilles-Barcelona cable was interrupted on November 1st, but communication was restored on November 4th after three days' interruption. The cost of these four repairs, viz., £6,447, has been charged to revenue.

Vickers, Sons & Maxim, Ltd.—The directors have declared a final dividend of 1s. per share (free of income-tax) on the ordinary shares, making 2s. per share, or 10 per cent. for the year, carrying forward £103,970.

Liverpool District Lighting Co., Ltd.—The directors have declared a dividend at the rate of 4 per cent. per annum (less income-tax), for the half-year ended December 31st, 1910

North Metropolitan Electrical Power Distribution Co., Ltd.

Mr. J. Devonshire (chairman) presided on Friday at the offices, Kingsway, W.C., over the thirteenth ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 393), the Chairman said that at the last meeting he stated that the directors looked forward to be able to recommend the payment of a reasonable dividend for the year 1910, and they would already have seen from the report that, without in any way restricting the provision for depreciation, they were able to suggest the payment of a 4 per cent. dividend. It had taken some years to arrive at this dividend-paying position, but, having arrived, he saw no reason why they should not comfortably continue there. The revenue for the year showed a satisfactory increase of £2,016, or 16 per cent. The expenditure showed an increase of only £1,017, or 10 per cent. upon the year 1909. A satisfactory feature had been the expansion of business in connection with each one of the undertakings, the balances carried to general revenue account from each undertaking being a substantial improvement on the previous year, as the following figures showed: Barnet, last year £2,316, previous year £2,010; Enfield, last year £1,343, previous year £815; Hertford, last year £1,507, previous year £1,308; St. Albans, last year £854, previous year £673. Turning to the balance-sheet, he would remind them that at December 31st, 1909, there was an item of £6,070 on the debtors' side which did not now appear. This was explained by the reduction in the capital account now shown on the credit side at £65,247 instead of £73,170 at the end of 1909. An explanation of this reduction was to be found in the report, where it was stated that the Enfield sub-station, buildings and plant had been taken over by the North Metropolitan Electric Power Supply Co. as from September 30th last. Previous to that date arrangements existed between the two companies, whereby the power company had, to some extent, the use of this sub-station to enable them to give their supply for local traction purposes. With the opening of further light railways in the district the demands of this supply were considerably increased, and the boards of both companies felt it desirable to place the Enfield undertaking on the same basis as the other undertakings, and that the ownership of the sub-station, buildings and plant should be vested in the Power Supply Co. They would notice that the balance-sheet was a perfectly clean one, the preliminary expenses having been written down to the nominal sum of £50, and the Wembly order—the only order held by the company under which an undertaking was not operated—standing at cost price. The figures in the report showed that the adverse effect of the metal-filament lamps had been more than counteracted by additional connections to the mains.

Mr. Geo. Offor, in seconding the motion, said that with regard to their business, he would like to point out how one town varied from another. At Enfield, for instance, where they had a large population of 42,738, they had made less progress in the consumption of current in four years than they had at St. Albans with only two years' working and with a population of only 16,019. The same thing applied at Barnet, with a population of 7,876 against the market town of Hertford with a population of 9,322, the consumption of current at Barnet being 938,160 units against 211,813 at Hertford. The four towns were being supplied on a thoroughly up-to-date system, taking their current in bulk from the supply company on moderate terms, and he thought the prospects for the future were as bright as their position was that day.

The motion was carried, and on the proposition of the Chairman, seconded by Mr. A. L. Barber, Mr. Offor was re-elected a director.

Rees Roturbo Manufacturing Co., Ltd.

The second annual meeting of this company was held at the works at Wolverhampton on February 27th, Mr. James Underhill presiding in the absence of Alderman C. T. Mander, who was in America.

The Chairman read a letter from Alderman Mander, in which he expressed the opinion that the progress of the company since its formation had been exceedingly satisfactory, considering that they were developing complicated and very elaborate patents, and that the shares which were offered in the prospectus were not taken up by £25,000 of the amount asked for. While the orders for the first six months were not so satisfactory as might have been expected, owing to a variety of circumstances, the orders for the last six months had shown a most satisfactory and steady rise. They were developing a large foreign trade, which, no doubt, would shield them from fluctuations of the home trade having much effect upon them, and he looked forward in the near future to seeing the company in a very flourishing condition. It was satisfactory to know that their patents were now acknowledged and passed through the patent offices all over the world.

Mr. Underhill, in moving the adoption of the reports, regretted that the accounts were not so satisfactory as they hoped for last year, and that they were not able to recommend the payment of a dividend on the preference shares. He looked upon this, however, as only deferred for a short time till they could get their turnover to the figure it ought to be for the size of the works. The past year upset their calculations in this respect because of the general trade depression which existed throughout the country during the first part of 1910, with the result that the first six months of the financial year showed a considerable reduction in their orders. The main cause must have been a general one, because their electrical orders dropped in about the same proportion as those on the hydraulic side of the business; but he was glad to say that the second six months of the year recovered the lost ground, and they booked almost double the value of the orders secured in the first half of the year. This higher rate was being maintained in the present year, and they were now running night and day, and had increased the number of workpeople, which had dropped in the middle of last year by 25 per cent., until they were now at the maximum figure they had touched since the company was formed. Their experiments had been exceedingly successful, and with regard to the pumping branch they were thoroughly standardised, and doing a large turnover. They were now building machines up to 400 and 500 h.p., whereas a year or 18 months ago their largest sizes were 50 to 100 h.p. Their foreign trade was developing rapidly, and they were creating big markets in the British Colonies, and also sending heavy machinery to China and South America. They had also thoroughly established themselves in the colliery world, and large pumps which had been running continuously for two or three years had demonstrated the principle of the Roturbo patents under, perhaps, the most difficult conditions. A large number of motor-driven pumps was in the shops at the present time for the British Admiralty. As far as the electrical branch of the business was concerned, they were busier than they had been for some time.

Mr. Rees seconded the adoption of the report, remarking that they had turned out between 1,300 and 1,400 pumps since starting to manufacture them. Now that they were entering the field for condenser work they should get a rapid increase in the business

The report was adopted.

Crossley Bros., Ltd.

Mr. Kenneth Crossley presided at the annual meeting on February 27th, and in moving the adoption of the report (see Electrical Review, page 315), he first alluded to the absence of Sir W. Crossley in Egypt, on holiday. In regard to the results of the year, the increase in the net profit was only about £6,000, but it followed up an increase of £25,000 in the previous year, and in certain directions they had had rather special expenditure to meet, for which they had not yet received the full benefit. They had embodied improvements in their standard types of gas engines, and brought out several entirely new models, which had necessitated considerable extra expense in making new patterns and new jigs and tools for dealing in the most efficient way possible with these new designs. All this extra cost had been debited entirely to revenue account. In gas plants they had been energetically pushing forward the developments mentioned last year, and had now a large number of installations working well on all sorts of more or less waste fuels, such as spent tan, cottonseed refuse, cocoanut shells and coffee husks, besides peat, lignite, brown coal, and some of the very inferior bituminous coals, so common in foreign countries. It had come to be generally recognised that they could give satisfactory and economical results with gas engines and gas plants in cases where boilers are quite unsuitable. The sales have increased considerably, and they might fairly expect to benefit in the near future by a better profit on the larger turnover. In regard to oil industry development, everything pointed to a very bright future for crude oil engines, especially in those countries and districts near the sources of supply. They might argue that the more oil engines came into favour the less would be the demand for gas plants, but so far they had not found that to be the case; in fact, both departments showed satisfactory increases, owing to the opening up of fresh fields. The chairman next alluded to the formation of their motor-car business into a separate company; it would be a great advantage to the business if both the manufacturing and selling were under one control. Mr. Crossley went on to refer to the balance-sheet and to the prospects of development.

British Insulated and Helsby Cables, Ltd.

The directors' report for the year ended December 31st, 1910, states that the profit amounts to £143,304, plus £42,269 brought forward, making £185,573. From this have to be deducted:—Directors' and debenture trustees' fees, and remuneration to Works' Committee less directors' fees receivable from other companies, £4,489; interest on first debenture stock, £22,500; accrued interest on second debenture stock, £264; depreciation on buildings, plant, machinery, &c., £20,000; transfer to special reserve account, £8,500; transfer to first mortgage debenture stock redemption account, £5,000; written off commission on issue of second debenture stock, £2,500; dividend on preference shares to December 31st, 1910, £30,000; interim dividend on ordinary shares to June 30th, 1910, £20,000; making £113,253, and leaving available for dividend a balance of £72,320. The directors recommend the payment of a further dividend of 6s. per share on the ordinary shares, making with the interim dividend already paid a total of 10 per cent. for the year ended December 31st, 1910, requiring £30,000, and carrying forward £42,320. The business during the past year has shown satisfactory growth, and this is largely due to the orders obtained through the foreign agencies and connections. It will be seen that a sum of £8,500 has been transferred to special reserve account, a further £5,000 to first mortgage debenture stock redemption account, £20,000 depreciation on buildings, plant and machinery, £2,500 written off commission on issue of second mortgage debenture stock, and the amount carried forward is £42,320.

MARKET QUOTATIONS.

Wednesday, March 15th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac, Sal	,,	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a ,, ,,	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16	..
a Ferro-Silicon (50 %)	,,	£12 10	..
a Copper Sulphate	,,	£21	..
a Lead, Nitrate	,,	£25	..
a ,, White Sugar	,,	£22 15	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt.	80/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70 %)	,,	£11	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	8d.	..
a ,, Cyanide (basis 100 %)	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£75	..
b ,, Wire, in ton lots	,,	£102	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	6¾d.	..
c ,, Tube (brazed)	,,	8½d.	..
c ,, ,, (solid drawn)	,,	6¾d.	..
c ,, Wire, basis	,,	6½d.	..
c Copper Tubes (brazed)	,,	8½d.	..
c ,, ,, (solid drawn	,,	8½d.	..
g ,, Bars (best selected)	per ton	£70	..
g ,, Sheet	,,	£70	..
g ,, Rod	,,	£70	..
e ,, (Electrolytic) Bars	,,	£57 15	..
e ,, ,, Sheets	,,	£78 10	..
e ,, ,, Rod	,,	£61 10	..
c ,, ,, H.C. Wire	per lb.	7¾d.	..
f Ebonite Rod	,,	6/-	..
f ,, Sheet	,,	5/6	..
n German Silver Wire	,,	1/11	..
h Gutta-percha, fine	,,	8/6	..
h India-rubber, Para fine	,,	6/7	5d. dec.
l Iron Pig (Cleveland warrants)	per ton	48/4½	3½d. dec.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Ingot	,,	£13 5 to £13 10	5/- dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£10	..
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d ,, ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, ,, large	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	166/6	..
e Silicium Bronze Wire	per lb.	8½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£177 10 to £178 10	£10 dec.
n ,, Wire, Nos. 1 to 16	per lb.	2/1	1d. dec.
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh's (Vieille Montagne bnd.)	,,	£28	15/- dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Prospectuses.—*Mississippi River Power Co.*—This week there have been offered for subscription $3,500,000 first mortgage 5 per cent. 40-year gold bonds at 88½ per cent., with bonus of 20 per cent. common stock.

The Christchurch (New Zealand) Tramway Board Loan, 1910.—The list of applications was to close yesterday in an issue of £61,400 debentures (4½ per cent.) at 103.

The Rhondda Tramways Co., Ltd.—An offer of £200,000 five per cent. first debentures, at 94 per cent., has been made this week, the list closing yesterday.

Colne and Trawden Light Railway Co.—This company held its annual meeting on March 2nd, when it was reported that the number of passengers carried during the year was 2,140,460, or an increase of 190,601. A dividend of 6 per cent. was declared, and £500 was added to the reserve fund. Mr. J. T. Landless, of Colne, was appointed on the board in place of the late Col. Chapman.

City of London Electric Lighting Co., Ltd.—Warrants in payment of the balance dividends for the year 1910 on the preference and ordinary shares have been duly posted.

STOCKS AND SHARES.

Tuesday Evening.

THE outstanding features in the Stock Exchange markets are the troubles in Mexico and the rocketing rise in London General Omnibus Ordinary stock. Apart from these, the general markets are rather placid, and business is proceeding jog-trotwise. There are rumours to the effect that the Wall Street Stock Exchange is putting out feelers with a view to taking a hand in the market for Rubber shares, but how much reliance can be placed upon them we are unable to say.

Mexico has been rather a thorn in the Stock Exchange flesh for the past six months, and now the trouble has come to a very definite head. As usual, where Mexican matters are concerned, the absence of reliable information is marked; but obviously, the country is in a very unsettled condition, and the uncertainty finds natural reflection in the prices of the Latin-Canadian group generally.

Mexican Light and Power Common shares fell 2½, but the fall is more pronounced in the 7 per cent. Preference stock, where the quotation is not only 3 points down, but has been widened considerably. The 5 per cent. Bonds are flat, too, and Mexican Electric Light 5 per cent. Gold Bonds have fallen 1½. Mexico Tramways dropped 2½, and the Bonds the same amount. Monterey Railway, Light and Power 5 per cent. First Debenture stock eased off to 91. The price of Rio Trams dropped to 108½, and the 5 per cent. First Mortgage Bonds remain at 100½, while the Seconds are 97¾. Vague talk runs of the United States intention to annex Mexico, but this consummation, highly desirable as it would be from the standpoint of proprietors of Mexican financial interests, could hardly be arrived at without much expenditure of time and negotiation—putting it mildly.

Electricity Supply shares continue steady on the whole at their improved levels. Metropolitan Ordinary fell ⅛ on the report noticed here last week, and Newcastle-on-Tyne Preference shed its rise. Notting Hill recovered half the deducted dividend of 10s. a share. South Metropolitan Preference gained its dividend of 8¾d., and other *ex* dividend markings have been fairly well shown in the prices. Edmundson's Preference are in demand, even at their advanced quotation showing a 5s. rise.

In answer to the modest hint thrown out from this column last week as to the advisability of the electric lighting companies making organised efforts in connection with the Coronation festivities, it is pointed out with much courtesy that a special leaflet has already been prepared on this subject. At the same time it was also observed that as the Coronation coincides with the longest days of the year, some of the decorations in London were being specially arranged for non-illumination, while as regards the others, the comparatively short time that devices, &c., will be lighted up would make little difference to the profits earned by the companies at this festive time, although indirectly, of course, the gains would certainly be swollen.

Brush Electrical First Debenture stock has put on a further 2 points. British Insulated and Helsby Cable shares are firm on the publication of an excellent report. Callenders Preference are ⅛ harder.

The Home Railway Market has been unsettled by heavy profit-taking after a big rise, and the steam stocks are decidedly off colour. This has affected Central London Deferred to a small extent, the price slipping back a point, but City and South London rose ½. Metropolitans and Districts are steady without showing much change. Business has been done in Great Northern and City Preferred Ordinary at 17s. 6d., and rather a feature is a good rise in East London Ordinary, which put on the fraction at 5⅛, while the Debenture stocks also hardened.

Telegraph stocks are firm without special movement, except in the case of West India and Panama shares, these rising sharply on the consideration that the Mexican insurrection will bring an enormous amount of extra business to the company. The movement has not extended to the Preference shares, which are unaltered at last week's prices. The Eastern group shows scarcely any change. Great Northern are a little easier, but Indo-Europeans hardened up to the extent of 30s. A fresh bout of buying caused Anglo-American Deferred to put on ¼, the other issues remaining firm. Direct United States cable shares are slightly easier, and Western Telegraph lost ⅛.

Excitement in connection with the National Telephone Company is dying down. Those who have bought the Deferred up to the present price are evidently content to await further developments, but there has been very little profit-taking, and the price keeps remarkably steady, with a loss of no more than a point on the week. Elsewhere in the Telephone market United River Plates are ⅛ better, and beyond this there are no changes.

Amongst the industrial issues not mentioned already, Willans and Robinson Preference are weak, dropping to a sovereign for the £5 shares fully-paid; otherwise the market shows a fair amount of strength. Henleys rose ¼, and India-Rubber shares gained an equal amount. Telegraph Construction shares are *ex* 36s., and were put down nominally £2. There has been a point rise in Underground Electric Railway Income Bonds, which raised the price to 48 middle. Babcock & Wilcox shares continue to recede, the price at 5⅛ showing a further loss of ⅛.

The Mississippi River Power Company has been offering 3½ million dollars of First Mortgage 5 per cent. gold bonds at 88½, the bonds carrying the right to a bonus of 20 per cent. in common stock of the company. This is an undertaking for the operation of a hydro-electric plant near Keokuk, on the Mississippi River. It is expected that the initial units for the generation of 120,000 H.P. will be ready in 1913, and contracts for the supply of half this output have already been secured.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1907.	1908.	1909.	1910.	Closing Quotations March 7th.	Closing Quotations March 14th.	Business done week ended March 14th, 1911. Highest	Lowest.	Rise + or Fall —	Present Yield per cent £ s. d.
300,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	5⅝ — 6⅝	6 — 6⅝	6⅞	6¼	+ ¼	Nil.
$263,244,000	Do. 5 % Deb. Red. Iss. at 98 % script all paid	Stock	5 %	5 %	5 %	5 %	96 — 98	96½ — 98½	97¼	..	+ ½	5 1 6
$255,196,000	American Telephone & Telegraph, Cap Stock ..	$100	8 %	8 %	8 %	..	147 —149	147 —149	..	..	..	5 7 5
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93 — 95	93 — 95	94⅜	..	..	4 4 3
545,920	Anglo-American Telegraph	Stock	3½%	£3 4s.	3⅜%	3¾%	68½ — 70½	68½ — 70½	69½	69⅜	..	5 6 5
3,227,040	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	111½ —112½	111½ —112½	112¼	111½	..	5 6 8
3,227,040	Do. do. do. Deferred	Stock	1 %	8/-	25/-	30/-	27 — 27½	27½ — 27⅝	27⅛	26⅜	+ ⅛	5 9 1
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	102 —104	100 —102 xd	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7 1/16 — 7 5/16	7 1/16 — 7 5/16	..	..	..	5 9 5
2,462,309	Commercial Cable, Sting. 500 year 4% Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	86½ — 88⅝	86½ — 88⅝	87⅜	86¼	..	4 10 5
16,000	Cuba Telegraph	10	6 %	6 %	6 %	..	9 — 9⅜	9 — 9⅜	..	..	..	6 3 1
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	..	17 — 18	17 — 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4%	3⅜ — 4	3⅜ — 4	..	..	..	5 0 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10%	8½ — 9	8½ — 9	..	..	..	5 11 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
60,710‡	Direct United States Cable	10	4½%	4½%	4 %	5 %	7⅞ — 8	7¼ — 7⅞	7⅞	7½	— ¼	6 9 0
32,500	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99½ —101½	99½ —101½	..	..	..	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	135 —138	135 —138	137½	135½	..	5 2 2
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	83½ — 85½	83½ — 85½	85⅝	84⅝	..	4 1 10
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	101½ —103½	101½ —103½	103½	102	..	3 17 4
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	13½ — 13⅝	13½ — 13⅝	13⅝	13 3/16	..	5 2 9
752,400	Do. 4 % Deb. Stock..	Stock	4 %	4 %	4 %	4 %	99½ —101½	99½ —101½	..	..	..	3 18 10
200,000‡	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100½ —102½	100½ —102½	..	..	..	3 18 1
181,127	Globe Telegraph and Trust	10	5⅞%	5⅞%	5⅞%	..	10⅜ — 11	10⅜ — 11	10⅜	10 2/16	..	5 4 4
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	..	13 — 13½	12⅞ — 13⅜	13 1/16	13	— ⅛	4 9 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	18 %	18 %	..	32½ — 33½	32 — 33	..	..	— ½	5 8 0
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	..	56½ — 58½	58 — 60	58½	58½	+ 1½	5 8 4
$41,380,400	Mackay Companies Common	$100	4 %	4 %	4½%	5 %	94 — 97	93 — 96 xd	..	..	..	5 4 2
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	76 — 78 xd	17/-	..	..	5 2 7
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	..	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	+ 1/32	5 17 1
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	2 5/16 — 2 7/16	2 5/16 — 2 7/16	..	..	..	5 11 1
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104 —105	104 —105	104⅛	104⅛	..	5 14 3
3,725,000	Do. do. Def. Stock	100	6 %	6 %	6 %	6 %	138 —140	137½—139½	140½	137	— ½	4 6 0
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	10⅛	10 1/32	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10⅛ — 11	10⅛ — 11	10 1/16	..	..	5 9 1
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅛ — 6⅛	5⅛ — 6⅛	6	5 13/16	..	4 1 8
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98½—100½	98½—100½	..	..	..	3 9 8
1,983,593	Do. do. 4 % Deb. Stock Red... ..	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid..	1	8 %	8 %	8 %	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	4 11 5
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	..	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	4 7 3
195,955	Do. do. do. 4 % Red. Deb. Stock..	100	4 %	4 %	4 %	4 %	87 — 89	87 — 89	8⅛	88	..	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	98½—100½	98½—100½	..	..	..	3 19 7
11,889	Reuter's	8	5 %	5 %	5 %	..	7⅞ — 8	7⅞ — 8	..	..	..	5 0 0
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	96½ — 98½	96½ — 98½	..	..	..	4 11 5
2,992	Submarine Cables Trust..	Cert.	6 %	6 %	6 %	..	133 —136	133 —136	..	..	..	4 8 3
150,000	United River Plate Telephone	5	8 %	8 %	8 %	..	7 1/16 — 7 1/8	7 1/16 — 7 3/16	7 3/32	7⅛	+ ⅛	5 2 5
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 7 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1¼ — 1⅜	1¼ — 1⅜	..	..	..	4 3 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 — 100	98 —100	..	..	..	4 0 0
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930 ..	10	7 %	7 %	7 %	6 %	13⅜ — 14⅛	13¾ — 14	13⅞	13½	— ⅛	4 5 9
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 —104	100 —102	..	..	..	3 18 5
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	2⅛ — 2⅜	2⅜ — 2⅞	59/4½	45/-	+ ½	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10 — 10½	10 — 10⅛	10 5/16	10¼	..	5 14 3
4,669	Do. do. 6 % Cum. 2nd Pref.	10	£2 6	15 %	14½%	..	9 — 9½	9 — 9½	..	..	..	6 6 4
80,000‡	Do. do. 5 % Debs., Nos. 1 to 800 ..	100	5 %	5 %	5 %	5 %	101½—103½	101½—103½	..	..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	5 %	..	4⅞ — 5⅛	4⅞ — 5⅛	5 1/16	99/4½	..	4 17 7
500,000	Do. 5 % 2nd Pref., 800,000 to 1,300,000	5	..	..	5 %	..	4⅝ — 4⅞	4⅝ — 4⅞	96/3	..	..	5 2 7
4,465,674	Do. 4 % Deb. Stock	Stock	..	4 %	4 %	4 %	92 — 93½	92 — 93½	92⅝	92	..	4 5 7
329,002	Auckland E. Trams, 5 % 1st Mort Deb. Stock ..	100	5 %	5 %	5 %	5 %	104½—106½	104½—106½	..	..	..	4 13 11
830,000	Babcock & Wilcox, 1 to 830,000	1	20 %	20 %	24 %	..	5⅝ — 5¾	5 1/16 — 5 1/8	5⅛	5⅛	— 3/16	4 4 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	..	1⅛ — 1⅜	1⅛ — 1⅜	30/-	..	..	4 0 0
600,000	British Columbia E. Rail Def. Ord. Stock	100	8 %	8 %	8 %	..	145½—148½	145½—148½	148	..	..	5 7 5
600,000	Do. Pref. Ord. Stock	100	5 %	6 %	6 %	..	125 —128	125 —128	127	..	..	4 18 9
600,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	..	109 —112	109 —112	110⅛	..	..	4 9 8
280,800	Do. 4½ % 1st Mort. Deb., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
210,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
183,801	British Electric Traction	10	Nil	Nil	Nil	..	1⅛ — 2⅛	1⅜ — 2⅜	40/-	35/-	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	3 %	1½%	Nil	..	4⅛ — 4⅜	4⅛ — 5 1/16	97/6	92/6	..	Nil
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	95 — 99	95 — 99	97½	96	..	5 1 0
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	75 — 80	75 — 80	..	..	..	5 9 9
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	7 — 7¼	7 — 7¼	..	..	..	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅞ — 6⅛	5⅞ — 6⅛	..	..	..	4 16 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
201,579‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
500,000	British Westinghouse 10 % Pref., 1 to 200,000 and 275,001 to 575,000 Non-cum.	5	Nil	Nil	Nil	..	⅞ — 1	⅞ — 1	10/-	9/3	..	Nil
1,241,358	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	59 — 62	59 — 62	61½	..	..	6 9 1
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	13/16 — 15/16	13/16 — 15/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,888	Brush Electrical Engineering, Ord., 1 to 140,338 ..	2	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
199,835	Do. do. Non-cum. 7 % Pref... ..	2	Nil	Nil	Nil	..	1/8 — 3/16	1/8 — 3/16	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	54 — 59	56 — 61	60	..	+2	7 7 7
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	38 — 43	38 — 43	..	..	..	10 9 4
137,610	Calcutta Trams, 1 to 137,610	5	6 %	4½%	4½%	..	5⅜ — 5⅝	5⅜ — 5⅝	5 3/16	..	..	3 16 7
47,295	Do. 5 % Cum. Pref., 1 to 47,295 ..	5	5 %	5 %	5 %	..	4⅝ — 5⅛	4⅝ — 5⅛	5 3/16	5⅛	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 — 100	97 —100	..	..	..	4 10 0
35,000	Callender's Cable Construction shares	5	15 %	15 %	10 %	..	9⅛ — 9⅜	9⅛ — 9⅜	9⅛	..	..	5 0 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	4⅜ — 5	4 13/16 — 5 1/16	5	..	+ 1/16	4 18 9
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	10/9	10/-	— 1/16	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	12 %	12½%	17½%	..	3 3/16 — 3 5/16	3 3/16 — 3 5/16	64/9	64/6	..	5 6 1
205,869	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4 %	4½%	4½%	103 —106	103 —106	103⅜	..	..	4 4 11
1,854,720	Central London Railway, Ord. Stock	Stock	3 %	3½%	3 %	3 %	66 — 68	66 — 68	67	66	..	4 8 3
572,640	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	85½	85½	..	4 13 0
572,640	Do. do. Def. do.	Stock	2 %	2½%	2 %	2 %	49 — 51	48 — 50	49½	48	—1	4 0 0
1,480,000	City and South London Railway	Stock	2½%	1½%	1⅜%	1½%	29 — 30	29½ — 30½	30 1/32	29⅜	..	4 18 4
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	Nil	Nil	..	½ — ⅝	½ — ⅝	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 1,100 of £50 Red	..	5 %	5 %	5 %	5 %	70 — 80	70 — 80	..	..	..	6 0

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Shares.	Dividends for the last four years.				Closing Quotations March 7th.	Closing Quotations March 14th.	Business done week ended Mar. 14th, 1911.		Rise + or Fall —	Present Yield per cent.
		*	1907.	1908.	1909.	1910.			Highest	Lowest		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	6 %	5 %	..	7/- — 1	7/- — 1	-/-	..	..	5 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	..	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
265,480	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	-/-	..	..	4 10 0
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12½ — 13½	12½ — 13½	..	..	..	4 10 7
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	2½%	Nil	Nil	..	9/16 — ¾	9/16 — ¾	12/9	11/3	..	Nil
17,139	Do. "A" shares, 01—017,139	5	2½%	Nil	Nil	..	1⅞ — 2⅛	1⅞ — 2⅛	38/9	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	65 — 69	66 — 70	67	..	+1	5 14 4
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	80 — 83	80 — 83	..	..	..	6 0 6
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	3/4 — 1	3/4 — 1	18/-	15/-	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	..	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	7 0 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	8 — 8¾	8 — 8¾	..	..	..	5 17 8
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	85 — 90	85 — 90	..	..	..	4 8 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	½%	Nil	Nil	..	3/4 — 1	3/4 — 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½ — 10⅝	10½ — 10⅝	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103½	..	..	..	4 16 10
40,000	Henley's (W.T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12½ — 13	12⅝ — 13¼	13¼	12⅞	+ ¼	5 13 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	4¾ — 5⅛	4¾ — 5⅛	..	..	..	4 7 10
150,000	Do. do. 4½ % Mort. Deb Stock	Stock	4½%	4½%	4½%	4½%	107 —109	107 —109	..	..	..	4 5 9
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	..	15⅝ — 16⅛	16 — 16⅜	16¼	16½	+ ¼	5 19 5
37,500	†Liverpool Overhead Railway, Ord.	10	½%	Nil	Nil	1¼%	2 7/16 — 2 9/16	2 7/16 — 2 9/16	..	..	..	5 9 1
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	7¾ — 7⅞	7¾ — 7⅞	..	..	..	6 9 0
600,070	London United Trams. (1901) 1 to 50,007	10	3 %	Nil	Nil	Nil	1¼ — 2⅛	1¼ — 2⅛	..	..	..	Nil
899,930	Do. do. 50,008 to 100,000	10	3 %	Nil	Nil	Nil	1¼ — 2⅛	1¼ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	3⅜%	Nil	Nil	2¾ — 3⅛	2¾ — 3⅛	60/-	55/-	— ⅛	..
1,649,980	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	73 — 77	73 — 77	75	..	..	5 3 11
5,732,062	Metropolitan Consolidated	100	½%	½%	1 %	1½%	45⅞ — 46	45⅞ — 46⅛	46¼	45⅛	— ¼	2 8 9
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	66 — 68	66 — 68	68	66⅝	..	4 0 11
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	26½ — 27	27 — 27	27	26⅜	..	Nil
391,327	Metropolitan Electric Trams., Ord.	1	..	4½%	5%	..	1⅛ — 1 1/16	1⅛ — 1 1/16	19/9	..	..	4 14 1
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	3/32 — 5/32	3/32 — 5/32	8/-	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	15/16 — 1	15/16 — 1	17/9	17/-	..	5 9 7
589,183	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	..	101 —103	102 —104	103	101½	+1	4 6 7
$10,823,300	Mexico Trams Co., Common Stock	..	..	..	6 %	..	128 —129	125½ —126½	127⅞	125⅝	—1½	4 14 10
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	5 %	5 %	..	97½ — 98½ xd	95 — 96	97½	95½	—2½	5 4 2
245,000	Potteries Electric Traction	1	4 %	Nil	2 %	..	3/32 — 5/32	3/32 — 5/32	..	..	..	4 6 7
245,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	3/32 — 5/32	3/32 — 5/32	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	81 — 84	81 — 84	..	..	+1	5 7 2
37,350	Telegraph Construction and Maintenance	12	17½%	15 %	17½%	20 %	39 — 41	37 — 39	39½	37	— 2	5 19 5
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1919	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	5 %	5 %	..	102 —103	102⅜ —103	102⅝	..	..	4 17 1
2,818,700	Do. do. 4½ % Bonds	..	..	4½%	4½%	..	97 — 99	97 — 99	97⅞	97½	..	4 10 11
4,928,050	Do. do. 6 % Income Bonds	..	..	..	..	1 %	46 — 48	47 — 48	48	47	+ ½	2 1 8
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	10 %	5 %	Nil	..	1/16 — 3/32	1/16 — 3/32	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	6 %	3 %	..	1 — 1½	1 — 1½	17/6	..	— ¼	12 0 0
215,769	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	55 — 65	55 — 65	..	..	..	6 3 1

ELECTRICITY SUPPLY COMPANIES.

80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 80,449	5	10 %	10 %	10 %	10 %	7⅞ — 7⅞	7⅞ — 7⅞	7⅞	..	..	6 7 0
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7⅞ — 7⅞	7⅞ — 7⅞	..	..	..	4 18 11
402,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —103	99 —103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	..	4¼ — 4⅜	4 — 4½	83/9	81/3	— ½	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	..	4⅜ — 4⅝	4¼ — 4⅝	86/3	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	..	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	95 — 97	95 — 97	95½	..	..	4 2 6
49,436	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	5 %	4¼ — 4⅜	4¼ — 4⅜	..	..	— ⅛	5 8 1
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	7 %	7 %	11⅞ — 12⅜	11⅞ — 12⅜	12⅜	12	..	5 13 2
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	12⅞	12⅜	..	4 12 4
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	119 —123	119 —123	..	..	..	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	2 %	Nil	Nil	..	1⅜ — 2	1⅜ — 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	..	2⅝ — 3⅛	2⅝ — 3⅛	..	..	..	7 16 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	5 %	5 %	5 %	92 — 94	92 — 94	..	..	..	5 6 5
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	8 5/16	7⅞	..	5 19 5
55,000	Do. do. 6 % Pref., 40,001—80,000 and 120,001—135,000	10	6 %	6 %	6 %	6 %	10⅞ — 11⅜	10⅞ — 11⅜	11 3/16	..	..	5 5 6
450,000†	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —109	107⅛ —110½	110	106½	+1½	4 1 5
450,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	99 —102	100 —103	100¾	100½	+1	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	..	1/16 — 3/32	1/16 — 3/32	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	Nil	Nil	Nil	..	1½ — 2⅛	2⅛ — 2⅜	..	..	+ ¼	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	82 — 85	82 — 85	82½	82	..	5 5 11
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	5 %	5 %	..	81 — 83 xd	81 — 83	..	..	..	5 17 0
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	..	4¼ — 4⅜	4¼ — 4⅜	..	..	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	..	4¾ — 5⅛	4¾ — 5⅛	..	..	..	4 11 11
94,350	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	8½%	8½%	8½%	9 %	6⅞ — 7⅛	6⅞ — 7⅛	7	..	..	5 19 4
$1,526,500	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	5 %	5 %	..	102 —104	102 —104	..	..	..	4 16 2
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	8 %	8 %	9 %	7¼ — 7⅜	7 — 7⅜ xd	7⅜	7⅛	..	5 16 2
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	2½%	3 %	2 %	2 %	1 1/32 — 1 1/16	1 1/32 — 1 1/16	..	..	..	3 3 6
90,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	4¼ — 5⅛	4¼ — 5⅛	100/-	97/6	..	5 17 1
887,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4 %	4 %	4 %	91 — 94	91 — 94	..	..	..	4 5 1
200,000	Metropolitan Electric Supply, 100,001 to 300,000	5	6½%	5 %	5 %	5 %	4¼ — 4⅜	4⅜ — 4⅝	86/3	83/9	— ⅛	5 8 1
76,121	Do. 4½ % Cum. Pref. 1—76,121	5	4½%	4½%	4½%	4½%	4⅜ — 4⅝	4⅜ — 4⅝	87/6	..	..	4 17 4
250,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	84 — 87	84 — 87	..	..	..	4 0 6
$5,929,600	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	90¼ — 91½	88 — 90	89½	89	—3½	5 11 1
$13,586,000	Do. Light and Power Co., Ltd., Common	$100	4 %	3½%	4 %	..	91 — 93	88⅛ — 90½	90⅞	88⅜	—2½	4 8 5
$5,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	7 %	7 %	..	112 —113	108 —111	110⅝	108	—3	6 6 2
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	5 %	5 %	5 %	96⅛ — 97½	93⅛ — 95½	95⅜	93⅜	—2½	5 4 9
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	97 — 99	97 — 99	96⅝	95⅝	..	4 10 11
180,491	Newcastle-on-Tyne, 1 to 50,000 & 57,010 to 137,500	5	8 %	2½%	4 %	..	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	4 6 6
137,500	Do. 5% Pref., 1 to 137,500 Non.Cum.	5	5 %	5 %	5 %	..	4⅜ — 5⅛	4⅜ — 5	99⅛	99	— ⅛	5 0 0
150,000	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500	100	..	..	5 %	..	97⅛ — 99½	97⅛ — 99½	..	..	..	5 0 6
10,852	Notting Hill Electric Lighting	10	7½%	7 %	7½%	8 %	12⅛ — 13	12 — 12⅝	13	12⅝	— ⅛	6 5 6
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 ..	7 %	..	6⅛ — 6⅜	6 — 6⅛	..	..	— ⅛	5 7 8
120,000	River Plate Elcty. Co. Ord.	Stock	6 %	8 %	9 %	..	225 —235	225 —235	..	..	..	3 16 6
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	..	103 —113	103 —113	..	..	..	5 6 2
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 3
80,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	8⅜ — 8⅞	8⅜ — 8⅞	8 1/16	8 5/16	..	5 12 8
80,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6¾ — 7¼	6⅞ — 7¼	7⅛	..	..	4 16 7
150,000†	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	86 — 88	86 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	Nil	1½ — 2	1½ — 2	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	4 %	5 %	5 %	5 %	3 — 3⅜	3 — 3⅜	..	..	..	5 19 5
100,000	Do. do. 5 % 1st Mort. Deb.	100	..	5 %	5 %	5 %	101 —104	101 —104	..	..	..	4 16 3
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	Nil	Nil	3/16 — 5/32	3/16 — 5/32	..	..	..	Nil
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 — 1⅛	1 — 1⅛ xd	..	..	..	6 11 9
240,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	97 — 99	97 — 99	..	..	..	4 10 11
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	3/16 — 7/32	3/16 — 7/32	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1¼ — 2⅜	1¼ — 2⅜	..	..	..	10 10 6
271,700	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	82 — 84	83½ — 85½	..	..	+1½	5 5 3
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	5 %	5 %	..	7/8 — 1	7/8 — 1	..	..	..	5 0 0
110,000	Westminster Electric Supply, Ord.	5	10 %	10 %	10 %	10%	8⅛ — 8⅜	7⅞ — 8⅜	8⅜	8	— ¼	5 19 5
81,379	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	..	..	..	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 3 per cent. March 9th, 1911.

TRADE STATISTICS OF AUSTRALIA.

The following statement, showing the imports of electrical and similar goods into Australia during the year 1909, is taken from the recently issued official trade statistics; the figures for 1908 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1908. £	1909. £	Increase or decrease. £
Plumbago or graphite.—			
From Great Britain ...	5,000	6,000	+ 1,000
„ Ceylon	1,000	1,000	—
„ United States ...	—	1,000	+ 1,000
„ Other countries ...	1,000	1,000	—
Total ...	7,000	9,000	+ 2,000
Gas and oil engines.—			
From Great Britain ...	80,000	104,000	+ 24,000
„ France	1,000	1,000	—
„ United States ...	31,000	31,000	—
„ Other countries ...	2,000	3,000	+ 1,000
Total ...	114,000	139,000	+ 25,000
High-speed reciprocating steam engines.—			
From Great Britain ...	422,000	564,000	+ 142,000
„ Germany	8,000	13,000	+ 5,000
„ United States ...	41,000	30,000	— 11,000
„ Other countries ...	1,000	1,000	—
Total ...	472,000	608,000	+ 136,000
Dynamo-electric machines up to 200 H.P., static transformers, induction coils, electric fans and parts thereof.—			
From Great Britain ...	112,000	119,000	
„ Germany	25,000	32,000	
„ United States ...	61,000	71,000	
„ Sweden	1,000	3,000	See note *
„ France	3,000	4,000	
„ Italy	2,000	3,000	
„ Switzerland ...	2,000	3,000	
„ Other countries ...	2,000	1,000	
Total ...	208,000	236,000	
Dynamo-electric machines over 200 H.P. and parts.—			
From Great Britain ...	11,000	13,000	+ 2,000
„ Germany	6,000	9,000	+ 3,000
„ United States ...	2,000	10,000	+ 8,000
„ Other countries ...	—	1,000	+ 1,000
Total ...	19,000	33,000	+ 14,000
Generators for direct coupling to steam engines.—			
From Great Britain ...	18,000	25,000	+ 7,000
„ Germany	—	3,000	+ 3,000
Total ...	18,000	28,000	+ 10,000
Regulating, starting and controlling apparatus for all electrical purposes, including distributing boards and switchboards, except telephone switchboards.—			
From Great Britain ...	Included above. See note *	11,000	See note *
„ Germany		3,000	
„ United States ...		11,000	
„ Other countries ...		2,000	
Total ...		27,000	
Flue heated economisers, mechanical stokers, steam traps, steam turbines, superheaters, water purifiers.—			
From Great Britain	Included in motive power machinery below	35,000	—
„ Other countries		—	—
Total ...	—	35,000	—
High-speed reciprocating steam engines for direct coupling or directly coupled to electric generators or to pumps.—			
From Great Britain	Included in motive power machinery below	21,000	—
„ Other countries		—	—
Total ...	—	21,000	—
Motive power machinery not elsewhere specified.—			
From Great Britain ...	168,000	134,000	—
„ France	2,000	4,000	—
„ Germany	8,000	6,000	—
„ Switzerland ...	—	3,000	—
„ United States ...	46,000	50,000	—
„ Other countries ...	3,000	4,000	—
Total ...	227,000	201,000	

	1908. £	1909. £	Increase or decrease. £
Electroliers, gasoliers, pendants, brackets, &c.—			
From Great Britain ...	25,000	28,000	+ 3,000
„ Germany	4,000	4,000	—
„ Other countries ...	3,000	1,000	— 2,000
Total ...	32,000	33,000	— 1,000
Electric fittings and appliances; switches, fuses and lightning arresters.—			
From Great Britain ...	Included below. See note †	17,000	See note †
„ Germany		7,000	
„ United States ...		4,000	
„ Other countries ...		1,000	
Total ...	—	29,000	
Electric heating and cooking appliances.—			
From Great Britain	Included below. See note †	1,000	See note †
„ Other countries		1,000	
Total		2,000	
Other electric light and gas appliances (except gas meters.)—			
From Great Britain ...	Included below. See note †	62,000	See note †
„ Germany		39,000	
„ United States ...		12,000	
„ Other countries ...		13,000	
Total ...	—	126,000	
Rails, fishplates, &c., for railways and tramways.—			
From Great Britain ...	531,000	437,000	— 94,000
„ Canada	—	133,000	+ 133,000
„ Belgium	10,000	22,000	+ 12,000
„ Germany	44,000	70,000	+ 26,000
„ United States ...	172,000	140,000	— 32,000
„ Other countries ...	36,000	1,000	— 35,000
Total ...	793,000	803,000	+ 10,000
† *Telephones, telephone switchboards and appliances.—*			
From Great Britain ...	88,000	74,000	
„ Germany	44,000	8,000	See note †
„ Sweden	25,000	20,000	
„ United States ...	27,000	5,000	
„ Other countries ...	28,000	9,000	
Total ...	212,000	116,000	
Electrical articles: Accumulators, arc lamps, arc lamp carbons, cable and wire covered, carbon in blocks of 12 sq. in. and over, electrical vacuum tubes, measuring and recording instruments, prepared insulating tape.—			
From Great Britain ...	271,000	164,000	— 107,000
„ France	5,000	2,000	— 3,000
„ Germany	63,000	42,000	— 21,000
„ United States ...	24,000	11,000	— 13,000
„ Other countries ...	5,000	3,000	— 2,000
Total ...	368,000	222,000	— 146,000
Iron and steel wire.—			
From Great Britain ...	71,000	75,000	+ 4,000
„ Belgium	21,000	11,000	— 10,000
„ Germany	306,000	306,000	—
„ United States ...	166,000	158,000	— 8,000
„ Other countries ...	—	3,000	+ 3,000
Total ...	564,000	553,000	— 11,000

* In the 1908 returns this heading included also regulating, starting and controlling apparatus, distributing boards and switchboards, except telephone switchboards.

† In the 1908 returns this heading was switches, fuses, and lightning arresters, electric heating and cooking appliances, telephones, telephone switchboards, &c.

A Coal-Fuel Engine.—In a recent issue of the *Motor*, an experimental coal-fuel engine, invented by Mr. A. M. Low, of 15, Great St. Helens, E.C., is described. The novel part of the arrangement consists of several parallel pipes passing through an exhaust-heated chamber and the back of the combustion chamber, through which powdered coal is mechanically pushed, the gas given off passing into a miniature gas holder in which the pipes terminate under a water seal. From the holder the gas is drawn off by cylinder suction. Mr. Low has made such tests as are practicable with the engine in its experimental state and obtained with short continuous runs a coal consumption of under ·4 lb. per B.H.P.-hour.

CONSTANT CURRENT SUPPLY.

By PERCY GOOD and A. K. TOULMIN SMITH.

It is admitted by almost all electrical engineers that considerable cheapening of the cost of supply of electrical energy can only take place with an improved load factor, and that substantial reductions could be made to users taking a 24-hours supply. If the supply of electricity for power at 1d. per unit for a four-hours demand is profitable, a charge of ½d. per unit for 24-hours supply should be still more profitable. An effort has been made recently to obtain this satisfactory load in the case of private consumers, and, as will be shown, with success.

In any establishment where electric light is employed, the load cannot be kept constant over the 24 hours unless the whole of the current used for lighting is employed for some other purpose during the hours when the lamps are not burning. Having this in mind, the writers decided, some time ago, to try whether a constant load could not be obtained for a small establishment by utilising the lighting load, during the hours when the lamps were not burning, to heat sufficient water for the purposes of the bathroom and kitchen.

Undoubtedly the "Therol" system of heat storage is very good, but the use of an intermediary for holding the heat does not appear to be entirely necessary. As is well known, in this system the current is allowed to heat a mass of iron, and water is passed through this as required, the heat contained in the iron turning the water into steam, which is afterwards mixed with cold water in a special tap. By suitably adjusting the tap, water at any desired temperature can be obtained.

An attempt, however, was made to obtain a more direct method, and with this object in view, a tank suitably lagged and fitted with resistances was arranged to supply the kitchen and bathroom in the small establishment above referred to.

The tank was fitted with three heating units, which were well insulated therefrom. These were made up of the well-known Ward-Leonard resistances, each resistance being enclosed in a case made of a piece of gas barrel, and the remaining space inside the barrel filled with dry sand. The ends of these iron cases were fitted with reducing sockets into which pieces of ⅜-in. pipe were screwed, which were then taken out through the sides of the tank. In this way a good watertight heating tank was cheaply made, containing three separate heating units which were well insulated from the water. As iron has a high temperature coefficient and a fairly high specific resistance, it would, perhaps, be better if in future the resistances were wound with iron wire so proportioned that at 60° F. the wire took 10 per cent. too much, and when hot 10 per cent. too little current. This would then average out fairly exact with regard to the consumption of power and have certain thermal advantages, and also the advantage of rapidly heating up the water at the start.

The pressure of the supply was 210 volts, and the maximum current used by the lamps was 1·1 ampere, making a consumption of about 230 watts. The heating units in the tank were each arranged to absorb one-third of this amount, so that when all three were in circuit an amount equal to the maximum lighting load was being absorbed by the water.

In order to obtain a constant load, the three heating sections were connected to switches which automatically opened one after the other as the lighting load increased, thus cutting off current from the water and keeping the load at a constant value. The automatic switch which was designed for this purpose included a long-pull magnet, which provided all the pull necessary for operating the switches. The special magnet employed is without a past-history error, always so troublesome in the case of ordinary electro-magnets, so that it moves the switches in and out with great regularity. For the success of this system it is important to use a magnet without a past-history error, in order that the switches may cut in and out at the same current values.

As the load was to be constant a meter was not required, and its place was taken by the automatic switch, which besides being much less complicated and requiring less attention than a meter absorbed only about six watts, that is to say, not more than a meter would have taken.

To prevent overloading, a resistance was arranged to be put automatically in circuit in the event of the consumer exceeding his proper amount of current, the resistance being designed to reduce the pressure across the lamps by 10 to 15 per cent. This resistance, of course, was arranged to remain in circuit dimming the lamps until the load was again reduced to the normal.

The above installation has now been in use for the past 12 months, and with the constant load of 230 watts has been found to yield an ample supply of hot water for the requirements of the small household, three hot baths per week being regularly obtained, as well as all the water necessary for other washing purposes. In fact, a constant supply of 30 gallons of hot water per day has been available at a temperature of over 110° F., and water at this temperature is too hot for an ordinary bath.

In a 5 ft. 6 in. bath of ordinary shape such as is used in the house in question, 25 gallons is enough for a complete covering of the body, so that even if more baths had been required there would still in all probability have been ample hot water for all the other washing purposes.

It was found that if all current was cut off from the tank the temperature drop in four hours was only 5° F., but as the tank was placed in a very favourable position, it is possible that in ordinary circumstances the drop might be slightly greater.

Of course, the amount of water used in the kitchen of even a small house can be very great if the washing of utensils be done under a running tap. But this method of washing, besides being very wasteful, both of the water and the soap or other cleansing material, does not have a proper cleaning effect, and with this system of electric heating it ought to be rigorously suppressed.

As, however, the water has been carefully used in the present case, the installation has been found to be sufficient to supply all the ordinary requirements of the household of three persons, so that an additional heavy coil which was inserted in the tank in the first instance, and arranged to take 2,000 watts from a separate power supply, has been removed. In some cases, however, an auxiliary heavy coil would no doubt be an advantage, taking current through a meter, and arranged to be put in circuit by the consumer in cases of emergency.

At first it may be somewhat difficult to estimate the exact requirements of different households, but that is only a difficulty of the early stages, and would very soon be overcome by experience. The amount of water, however, supplied per person in towns, is about 30-35 gallons per day, so that three persons would average, say, 100 gallons per day. As this figure includes all the supply, it does not seem likely that the amount of hot water required would exceed 25 per cent. of this total. This amounts in the present case to 25 gallons, and experience during the past 12 months has shown that this provides a very fair basis on which to work.

In order to find out what supply to give a consumer, it will be necessary to ascertain his probable maximum requirements of electricity. Usually there will be little difficulty in this, but unless the records of a maximum demand indicator are available, it is advisable to allow a considerable margin above any information obtained from the consumer. The number of persons in the house, of course, can easily be found, which will give a fair idea of the probable amount of water required, as already explained. If the maximum lighting load be found to be much more than sufficient for the hot water, then an increase must be provided by inserting an additional permanent heating coil. If, however, it is found to be much more than sufficient, then the consumer should have the matter explained to him, and have the offer of the lower rate for at least a portion of his lighting load. In the case of a consumer who used carbon filament lamps, it is very unlikely that his maximum demand would be too small.

Now, the whole question of the successful introduction of such a system depends upon whether the supply companies will come forward and reduce the price of energy. If the price of supply be reduced from 5d. to ¾d., and the load is equivalent to the maximum demand throughout the whole

year, then the cost of supply for lighting and hot water will be about twice the previous lighting bill. Although the supply companies will be generating about twelve times as much as before, yet it will be on the excellent factor of 100 per cent., and they will be getting twice their previous revenue. This appears to be so much in their favour that even a lower price might reasonably be looked for in the future.

SUB-STATION TROUBLES.

[COMMUNICATED.]

The extension of electrical distribution systems has, in many cases, rendered the establishment of sub-stations necessary in order to convert power in bulk into distribution power, frequently under changed conditions as to voltage, type of supply and other matters. While there is undoubtedly a great advantage in this, it is worth while to point out that sub-stations have their own peculiar dangers, which, unless guarded against, lead to disaster.

Both these dangers, to which reference will here be made, arise out of the absence of centralisation, which is inevitable with a sub-station system. Because of this there is danger both of poor plant and inefficient supervision as regards the sub-station. The generating station is usually a place frequently inspected, not only by the heads of the organisation, but by visitors, and a certain pride in its appearance and upkeep is engendered. This is not so much the case with a sub-station, which is usually situated at some distance from the centre of operations, is poked into any convenient or inconvenient corner, and is not so frequently the subject of critical inspection as the generating station. As a result there is frequently a temptation to relegate apparatus which is discarded from the generating equipment to the sub-station as being good enough.

An instance of this may be quoted. In one sub-station a type of switch for 3,000 volts had been transferred from the generating plant to an out-of-the-way location, because, although newer gear had superseded it, it could still perform its function of opening and closing the circuit. It was actuated by means of a screw projecting through the bottom of a metal case which entirely enclosed the switch, and in order to operate it a handle had to be fitted to the projecting end of the screw and turned in the required direction. On one occasion it was urgently necessary to open this isolating or dividing switch without delay, but unfortunately the handle had been mislaid, and there was nothing else available in the sub-station for use as a substitute. The opening of the switch was therefore delayed for about half an hour, and in consequence of this an important repair job had to be left over for another opportunity. The inconvenience occasioned in this way impressed on the management the uselessness of using scrap material in sub-stations, and the switch was removed, ordinary isolating plugs being substituted.

The necessity for careful supervision of sub-stations is further emphasised by another switchboard incident which, fortunately, did not lead to any serious result in the operating conditions, but which might easily have done so. The low pressure board in one sub-station was encased in an iron chamber or case which was fixed flush against the wall. As originally supplied, this case had been fitted with a water-tight cover, but as the removal and replacement of this when operating the dividing links and other gear was a matter of time and difficulty, the men neglected to put the cover on, and owing to insufficient supervision, this was allowed to become a practice. As a result, water, which collected in the ducts leading the distributing cables away from the sub-station, dripped down from the openings of the ducts, which were placed directly over the low-tension board, on to the top of the iron case, and then crept over the edge and along the inside of the case to the electrical contacts. This gave rise to earths on more than one occasion, and eventually the water-tight cover had to be replaced. This, however, would appear to be illustrative of two or three defects in sub-station management. In the first place, sub-station switchgear should be of a better design than that which invites the operators to be careless with it. Secondly, where water is likely to be found, to place any switchgear against a wall is a mistake; it should be kept clear to allow free space for trickling. Thirdly, the supervision should be such that, whatever apparatus was installed, it should be utilised in the way for which it was designed.

This question of supervision is a much more important one than may be imagined. In fact, it is the keynote of sub-station efficiency. In one instance, where a street lighting system was run from a rectifier switchboard in a sub-station, a connection at the back of the rectifier switchboard, which had probably been in a bad way for a considerable time, broke away entirely during a run and open-circuited the rectifier. The consequent sudden rise in voltage broke down the insulation on one of the coils, and there was some lively sparking in consequence. Fortunately, the attendant made the rectifier dead before much damage had occurred, and still more fortunately the defective coil was on the top and was repaired with little trouble. All the same, the breakdown would not have occurred if periodic inspection of the sub-station and its gear had been carried out in a thorough manner.

In one sub-station of considerable size it was found necessary to keep oil lamps burning constantly, in view of danger in the event of emergency, as no other provision could be made for lighting the place independently of the main supply, and the designers had thoughtfully placed the whole of the gear underground in a cellar. These lamps were found to be very troublesome indeed, as in order to be of any use they had to be placed quite near to the switchboard, and as a result the low-tension board was constantly in a villainous state of dirt owing to oily soot. It would have been far cleaner and certainly more in keeping with an electricity supply system if portable electric lamps with accumulators had been used for the purpose, but this was not done.

The overheating of sub-stations is a very common defect, and it would be well if designers of distribution systems would pay some attention to proper ventilation of such chambers. In some of these cases this fact has prevented the utilisation of any other means of lighting than electricity derived from the ordinary supply mains, although what would happen in emergency when the electric supply failed is past inquiry. In one system a supply of candles was put in every sub-station, but at the next emergency, when a rush was made for the candles, it was found that nothing was left but grease spots. In the next place paraffin oil lamps were tried, but it was found that the oil evaporated too quickly to be of any use, and the idea of an alternative method of illumination had to be dropped, although such alternative was really necessary in case the light should fail while men were at work in the sub-station.

Another important point in sub-station equipment which does not appear to receive adequate attention is the earthing of the apparatus. The "earths" employed are in many cases nothing short of ridiculous. In one instance an iron pipe leading to a gully which in dry weather was entirely destitute of water was the only "earth" utilised, while in one sub-station on an important system of supply the transformer cases, cable covers, &c., were earthed by connecting them all to a piece of very thin tinned copper strip, which in turn was connected to an earth plate. This copper strip, which was naturally very fragile, was nailed along the wall of the sub-station chamber close to the floor. The result was that the strip became broken without the knowledge of anybody—a thing which might easily have occurred by, say, the broom employed in sweeping the floor catching in a loose section of strip. As a consequence none of the apparatus in the sub-station was really earthed, and one of the attendants got a nasty shock from an earthing device. As the result of investigation, the break was discovered and repaired, and at the earliest opportunity a little capital was invested in heavier copper strip for earthing purposes.

Although the above notes cover a fairly wide range of the troubles to be found in sub-stations, they are not exhaustive. Their aim is to draw attention to the fact that it is not true that "anything will do" in a sub-station, either in equipment or maintenance. The sub-station should, as a matter of fact, be treated with more respect than the generating station, as it is frequently left for longer periods to look after itself.

GENERATING STATION RECORDS.

By "RESEARCH."

There is a great diversity of opinion amongst station engineers both as to what should be recorded and at what periods the records should be taken. Practice seems to vary from a switchboard attendant taking readings every quarter of an hour of everything possible, down to a few meters being read daily. As it is impossible to lay down a set of rules to suit every case, the author will take two typical cases, and indicate what records should be taken.

Records for Small Stations up to 500 kw. capacity.—A three-wire direct-current lighting and power station has been assumed, with a battery. If the station should happen to be a two-wire one, without balancer or battery, nine columns would have to be left out of the log sheet shown.

Date..... LOG SHEET Day.....

TIME	AMPERES															Volts Bus. Bar	
	GENERATORS					Balancer		BATTERY				Works		Total Generated	Mid. Wire		
	No. 1	No. 2	No. 3	No. 4	No. 5	+	−	+ C	+ D	− C	− D	Power	Light		+	−	+	−
12.0 night																		
12.30 a.m.																		
1.0 a.m.																		
12 mid.															METER READINGS			
12 mid.																		
Difference															Units for Day			

Coal used, tons..... cwt. ..... qr. ..... Total lb..... Water used, lb.....
Total Units generated..... Total Units used in Works..... Loss in Battery.....
Remarks :—

Fig. 1.

Records for Large Stations of over 500 kw. capacity.—A station suitable for a three-wire direct-current lighting and power supply, a bulk supply for traction purposes to a tramway department or company, and an alternating-current supply at high pressure to outlying districts, or sub-stations with rotary converters linking up the d.c. with the a.c. supply, has been assumed, as most requirements are thus covered. A suitable log sheet is shown in fig. 4. In large stations it pays to weigh the coal as it is delivered to the boilers. Some engineers argue that it is of little value, as the total weight per day obtained in this way does not agree with the weight of coal delivered at the station, owing to moisture and differences in the weighing apparatus. In the author's opinion, agreement between the two figures is really immaterial. What is required for economical working is to check one shift of men against another shift under

WORKS WEEKLY CARD.

Week ending..... 19.....
Units generated.....
Units used on Works.....
Lb. of Coal..... Lb. per unit.....
Lb. of Water..... Lb. per unit.....
Maximum Load of..... kw. on..... at .....
Standby Plant Capacity actually available at peak load..... kw.
Remarks :—

Fig. 2.

As the records are taken for the benefit of the chief engineer, let us consider his requirements. They will probably be as follows :—

1. Time and amount of maximum load.
2. Stand-by plant available at this period in case of accident.
3. Efficient running of generating plant. Two points have to be considered—first, continuity of supply ; secondly, coal costs.
4. The amount of out-of-balance, and how it is dealt with.
5. The useful and efficient employment of the battery. It is in small stations that batteries get the worst treatment, as sufficiently skilled attendance cannot be afforded.
6. The bus-bar pressure throughout the day. A pilot recording voltmeter is generally used, and the records are sent to the chief engineer with the log sheet. The difference between the pilot and bus-bar volts represents waste energy, and the chief's duty will be to balance cost of mains against loss of energy due to voltage drop.
7. The amount of coal used. In very few small stations is there any accurate attempt to weigh the coal used. Unless the weight of coal used per shift can be accurately found, it is of very little use spending a large sum on elaborate coal-weighing plant.

The log sheet shown in fig. 1, together with charts from the recording pilot voltmeters and earth recorder, will give the chief engineer all this information. It will be noticed that the meter-reading log sheet and the half-hourly instrument-reading log sheet are combined on one sheet.

A weekly card system will be found of great use, as it forms a permanent record, occupies a very small space, and allows the main items concerning the station to be quickly referred to. A works weekly card is shown in fig. 2, from which monthly and quarterly reports can be easily compiled.

WORKS DAILY CARD.

Day..... Date..... 19.....
Units generated, D.C.....
Units generated, A.C..... Total.....
Units used in Works.....
Units supplied for Traction.....
Lb. of Coal..... Lb. per unit.....
Lb. of Water..... Lb. per unit.....
Maximum Load of..... kw. on..... at .....
Standby Plant Capacity actually available at peak load..... kw. D.C.
..... kw. A.C.
Remarks :—

Fig. 3.

Date..... Day.....

LOG SHEET

TIME	D.C. Generators				AMPERES: Balancers				Battery				Works Power	Mid. Wire		A.C. Gener.		Rotary Converters		Sub-Stations		VOLTS		A.C. Power Factor	Traction			Total kw. Generated	
	No. 1	No. 2	No. 3	No. 4	No. 1+	No. 1−	No. 2+	No. 2−	+C	+D	−C	−D		+	−	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2	D.C. +	D.C. −	A.C.	No. of C.B.	Time Out	Time In	D.C.	A.C.
12.0 night														Works Lighting															
12.30 a.m.																													
11.30 p.m.																									Traction Meters				
12.0 night																									No. 1	No. 2	No. 3		
12 mid.																													
12 mid.																									METER READINGS				
Difference																									Units for Day				

Coal used, tons..... cwt. ..... qr. Total lb. ..... Water used, lb. ..... Traction Units .....

Total Units generated..... Total used on Works..... Loss in Battery.....

Remarks:—

FIG. 4.

similar conditions of load, &c. By comparing the pounds of coal consumed per unit generated obtained by one shift against another, coal costs can be reduced, the most efficient men picked out, and the inefficient men brought up to the mark. Qualities of coal can also be more readily compared by this more careful coal weighing.

A works daily card is shown in fig. 3, and by adding the time of the shift and a space for the shift engineer's name, it can be turned into an eight-hour shift card, to be entered up by the shift engineer in charge of the station for that period.

With regard to the recording instruments that are desirable for a large station, the following may be mentioned :—CO_2 recorder, steam pressure recorder, mid-wire recording ammeter, earth leakage recording ammeter, recording pilot voltmeters for direct-current and alternating supplies, main feeder recording ammeters and traction recording ammeter, voltmeter and rail drop instruments.

PROCEEDINGS OF INSTITUTIONS.

The Electrical Undertaking of the Birmingham District Drainage Board.

By L. F. Mountfort, A.M.I.C.E., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Birmingham, February 8th, and Manchester, February 28th*, 1911.)

Where the bulk of the sewage has to be pumped, the demand for power may be from 5 to 10 per cent. of the entire output of the central station supplying the district. Probably the largest undertaking of this kind in the world is that of the Birmingham, Tame and Rea District Drainage Board, which deals with the sewage from a population of about 1,000,000 persons.

The original plant consisted of small centrifugal pumps driven by portable steam engines at various localities. In 1905, the Corporation of Birmingham was about to erect a refuse destructor in the Nechells district, and the Drainage Board decided to adopt electric power, obtaining steam at a nominal figure from the destructor works. The method of distribution adopted was three-phase at 2,250 volts, overhead, with transformer sub-stations reducing the pressure to 200 volts for the motors. The plant includes two 115-kw. alternators driven by Belliss engines. The line is of hard-drawn copper wire carried on triple-shed porcelain insulators by creosoted wood poles. Where roads are crossed, steel terminal poles are used, and the line is taken under the road by a three-core cable laid solid in bitumen. The total length of line is 5½ miles, and the pressure drop at maximum load was designed to be 7½ per cent.

When electrical power had once been installed, its use very rapidly increased; it has been applied to every process throughout the disposal works requiring mechanical power, and is even used for the milking of cows.

TABLE I.—Motors Connected to Line.

	1910. H.P.	1906. H.P.
Sewage pumping	272	88
Screens, elevators, penstocks, &c.	30	15
Gravel and ash washers	30	—
Workshops and farm	18	18
Sewage distributors	10	3
Total	360	124
Maximum demand on station	150 kw.	100 kw.
Annual load factor	40 %	47 %
Diversity factor	2·40	1·24

Since 1906 there has been an increase in the connections of 175 per cent., but the maximum demand has only increased 50 per cent., and the diversity factor has almost doubled. As the steam supply became inadequate at certain times, a stand-by supply of electricity has been obtained from the Aston Corporation mains. The drop in the line has increased to 12 per cent. at peak loads, but this rarely occurs when lighting is required.

Taking the following figures as a basis of calculation, viz. :—

15 cwt. of refuse per 1,000 persons per day ;
50 units generated per ton of refuse burnt ;
30 gallons per head per day water supply ;
50 per cent. overall efficiency for line, motors and pumps ;

we find that the consumption in a destructor of the solid refuse of a district would be sufficient to raise six times the dry-weather flow of the sewage or liquid refuse to a height of about 30 ft.

As only a nominal sum is charged for the destructor steam, the cost per unit of output is almost in exact inverse proportion to the load factor. At unity load factor this amounts to about 0·35d. per unit generated. The average annual load factor of the plant is about 40 per cent., making the actual cost about 0·875d. The average power factor of the whole system is about 0·85.

Practically no trouble whatever has been experienced in the system since its installation five years ago.

The operations carried on, besides pumping, include screening and dredging (15 h.p.), driving two lime mixers (8 h.p.), sludge pressing (10 to 50 h.p.), and driving sewage distributors.

The new pumping station was installed for the purpose of dealing principally with the large excess flow brought down by the main outfall sewers in time of rainfall, and when completed will contain plant of a capacity of about 1,000 H.P. The sewage is lifted and distributed over a large area of bacterial filters.

There are at present 16 acres of filters at work, and the ultimate area provided for is 30 acres, upon which it is intended to deal with excess flows of sewage storm-water at a maximum rate of 100,000,000 gallons per day. The whole area is divided into sections of 2 acres each, which can be fed independently, and each acre requires about 600 jets. The watering of these filters is controlled by a system of electrically-operated sluice valves, as will be explained later, so that the area in work can be adapted to meet the varying rate of flow from hour to hour. The level of the surface of the filters is about 10 ft. above the general gravitational level, so that it has been necessary to install pumping machinery, the total lift, including the head on the jets, being about 19 ft.

The rate of flow of sewage during dry weather varies regularly from hour to hour during the day. The maximum rate is equal to about 1·5 times the mean, and occurs about mid-day, while the minimum rate, equal to about half the mean rate, occurs during the early morning.

In times of rainfall, however, this flow is subject to large and sudden variations, and at the Outfall Works at Nechells, a rate of flow of 10 to 12 times the normal "dry weather flow" has been measured. Although the rate of flow is very largely increased, the total extra quantity to be dealt with is small compared with the normal daily quantity.

Table II gives approximate values of the load factor for plants working between various limits of flow. In the case of the present pumping station the requirements were that it should deal with a maximum rate of flow of 70,000 gallons per minute, commencing at a rate of about 1½ times the normal "dry weather flow." The annual load factor in this case is about 3·5 per cent. for the whole plant. Under these circumstances the question of a high efficiency becomes of small importance compared with that of low first cost, and pumping machinery of the ordinary centrifugal type was decided upon.

TABLE II.—LOAD FACTORS OF SEWAGE PUMPING PLANT.

Values of Maximum rate of pumping / Mean rate of flow in dry weather	—	Values of Rate of flow at which pumping commences / Mean rate of flow in dry weather					
		0	1	2	3	4	5
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
	1	93	—	—	—	—	—
	2	56	20·0	—	—	—	—
	3	39	12·0	4·0	—	—	—
	4	30	8·7	3·0	2·0	—	—
	5	24	6·9	2·5	1·8	1·6	—
	6	20	5·8	2·2	1·6	1·5	1·3

The supply of electricity obtained from the Corporation mains is three-phase 50-period current at a pressure of about 6,000 volts.

The transmission is underground for 450 yards, and overhead for the remaining 950 yards.

Near the switch house is erected a hollow steel terminal pole, on which three horn-type lightning arresters are fixed, and the choke coils, consisting of about 10 turns of the line wire, are inserted between the line and the cables. The horn arresters were at first connected directly to earth without any resistance in the earth circuit; considerable trouble was, however, experienced, especially when the line was lightly loaded, the whole system being frequently shut down due to the arresters flashing over for no apparent reason. It was, therefore, decided to put special graphite resistances of 500 ohms in each length of the earth circuit. Trouble was also experienced due to snow lodging between the horns, and the whole terminal pole has now been covered over with a screen of expanded metal. Since then no trouble in the nature of shutdowns has been experienced. In the author's opinion, 6,000 volts is too low a pressure for the satisfactory employment of horn arresters when located in an exposed position, as the gap has to be so small that it is difficult to ensure its being kept free

A barbed aerial earth wire is strung across the tops of the poles, and is earthed at three points of the route by means of copper earth-plates.

The pumping-station is 120 ft. long and about 40 ft. in width. It contains two sets designed for a normal output of 4,700 gallons per minute, and two of 20,200 gallons each; a third set of the latter size will ultimately be installed. The pumps deliver direct into mains which feed the filters through nozzles or sprays, at a pressure of about 7 ft, and as this is about one-third of the total head, the characteristics of the centrifugal pump are brought into prominence. Fig. 1 shows the curves of head and volume for the ordinary type; any variation in discharge causes a variation in pressure, so that shutting off one filter would have caused a large change in the distribution to others on the same branch. This was inadmissible, and as induction motors were used, the speed of which could not be varied, the pump had to be modified. By making the vanes radial instead of backwardly curved, the author obtained the characteristics shown in fig. 2; over the best portion of the efficiency curve, between full and half load, the variation in head was only 15 per cent. As this type of pump discharges at a high velocity, an expanding discharge pipe is necessary to convert the velocity head into pressure, and this has also been utilised on the Venturi meter principle to gauge accurately the rate of discharge. The pump required a low speed, while the motors should have been high speed; a compromise was effected at 360 R.P.M. for the small sets, and 194 R.P.M. for the large ones, the total lift being 19 ft. The motors adopted were of the three-phase 50-cycle squirrel-cage type, direct coupled to the pumps, and their full-load rating was in all cases fixed 33 per cent. above the power required by the pump at normal output, because with radial vanes the power required

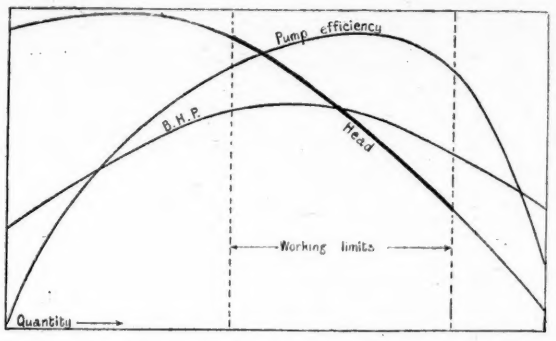


FIG. 1.—CHARACTERISTIC CURVES OF CENTRIFUGAL PUMP WITH BACKWARD CURVED VANES.

increases rapidly with any drop in head; the rating was chosen so that if the pressure fell to the level of the filter surface the machines would not be overloaded. The smaller motors are of 55 B.H.P. at 2,200 volts at full load, and the larger of 225 B.H.P. at 6,000 volts. The latter had at ¾ load a power factor of 0·80 and an efficiency of 0·89; in those first installed, the end-rings were divided into half as many sections as the number of poles, to improve the starting torque, but this gave rise to troublesome fluctuations in the rotor currents, and both machines were eventually fitted with continuous rings, with no appreciable loss of starting torque. The motors are started up with auto-transformers and oil switches.

During week-ends when the destructor steam is not available, the existing station is shut down and the supply taken from the 6,000-volt feeder. The synchronising gear is used for paralleling the two supplies in order to change over without the necessity of interrupting the supply. The 6,000-volt supply is also used to help the existing station during times of heavy load, or when steam is low, and no difficulty has been experienced in running the two supplies in parallel for hours at a time.

The transforming plant consists of three single-phase oil-cooled transformers, each of 100-K.V.A. capacity, with a ratio of 6,000 to 2,200 volts, and one 30-K.V.A. three-phase transformer with a ratio of 2,200 volts to 200 volts. The three large transformers are mesh-connected. The 200-volt supply is used for working the compressor motor, sludge-pump motor, sluice valve motors for the filter beds, and the station lighting.

In order to facilitate the operation of opening up the filter beds, and bearing in mind that when the scheme is complete it will be necessary to open 30 12-in. sluice valves in order to bring the whole plant into use, it was decided that these valves should be electrically operated from the pumping station, and for this purpose an overhead pole-line has been erected alongside the valves for supplying

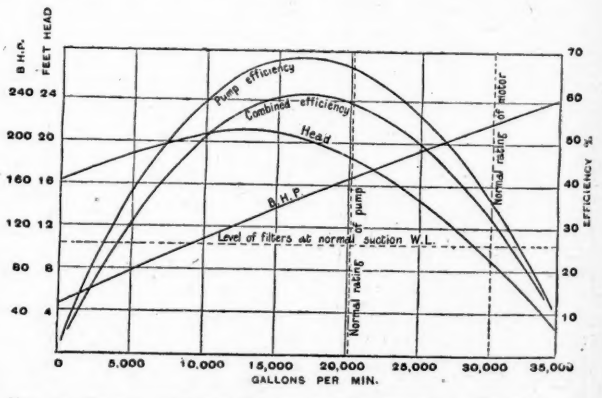


FIG. 2.—CHARACTERISTIC CURVES OF CENTRIFUGAL PUMP AND 225-H.P. INDUCTION MOTOR.

current to the small driving motors. The line consists of hard-drawn copper wires, there being six wires to each pair of motors, which are worked two in parallel. Each sluice valve has a small ½-H.P. three-phase totally-enclosed motor mounted on a bracket and operating through spur-wheel and worm-gearing, the time taken to open or shut the valve being about two minutes. The valves are installed two together in brick chambers with air-tight covers, and a pole is erected close to each chamber down which the tappings from the overhead line are taken, these consisting of V.I.R. cable in galvanised steel conduit. A limit switch is fixed on the sluice valve to break the circuit when the valve has reached

the top or bottom of its travel, and at the same time to leave the motor connected up to run in the opposite direction when the switch at the station is thrown over.

Table III gives the capital and working costs of the plant, taken over a twelvemonth from September, 1909, to September, 1910.

In starting up a set, the pump is first filled with water and then started up with closed delivery valve, a suitable transformer tapping being employed.

TABLE III.

Capital Cost.			
Transmission line and cable	£853	0	0
Motors and pumps (four sets only)	2,184	0	0
Transformers, switchgear and connections	1,887	0	0
Sluice-valve gear and accessories	1,330	0	0
Hydraulic mains and valves	2,000	0	0
Pump well and foundations	2,200	0	0
Superstructure	3,000	0	0
Total	£13,454	0	0
Cost per B.H.P. installed (when completed)	£18	0	0
Annual Cost.			
Interest and depreciation at 7 per cent per annum	£941	15	0
Working Expenses.			
Cost of power, 157,700 units at ⅜d.	£575	0	0
Wages	600	0	0
Maintenance and repairs, including oil, waste and stores	25	0	0
Total	£2,141	15	0
Total gallons pumped, 1,032 millions, against an average head of 19 ft.			
Overall efficiency of installation	47 per cent.		
Cost per W.H.P.-hour	5·15d.		

The whole pumping plant has now been in work for nearly two years, and no trouble whatever has been experienced during that time.

The British Thomson-Houston Co., Ltd., of Rugby, were the contractors for the whole of the electrical installation referred to in the first portion of the paper.

For the sewage pumping station, the contractors for the whole of the electrical equipment, with the exception of the 225-H.P. motors, were Messrs. Johnson & Phillips, Ltd., of Charlton, Kent. The 225-H.P. motors were supplied by Messrs. Crompton & Co., Ltd., of Chelmsford, and the whole of the pumping machinery by Messrs. W. H. Allen, Son & Co., Ltd., of Bedford.

Discussion at Manchester.

Mr. W. Cramp said it would be noticed that the author had drawn his curves of pressure and flow for the pumps with pressures as ordinates, so that the shape of the curve was comparable in every way with those for electrical apparatus. This was a great convenience. It would be seen that for the pump, the characteristic was of the same general shape as for the electric machine, but that the actual shape was dependent to some extent upon the shape of the vanes. Similar changes in the characteristic might be brought about in continuous-current electric machines by suitable compounding, and it, therefore, followed that by suitably arranging the windings of a D.C. motor, and the blading of a centrifugal pump, a combination would be obtained capable of providing from constant-pressure electric supply mains any "flow characteristic" that was desired. Polyphase motors did not lend themselves to the same adjustments; the author had to shape his vanes to suit the motor, thereby sacrificing to some extent the efficiency of the combination. Referring to fig. 2, the efficiency of the combination did not strike him as being at all high. This was, no doubt, partly on account of the radial vane adopted, but the disadvantages incident to this form might be considerably modified by providing the pump with a proper diffuser or whirlpool chamber, as well as with a volute. The author's trouble with divided end-rings, must have been due to the fact that there was no cross connection between the various sections, so that the rotor currents could not provide a resultant rotating field. He had used these divided end-rings with success, but only on single-phase motors.

Mr. S. J. Watson said that on looking up the records of the electricity department of the City of Birmingham, he found that the units sold last year amounted to about 30 millions, so that the units used by this particular sewage works only represented slightly more than half of 1 per cent. The author stated that the load factor was 40 per cent. for 1910 and 47 per cent. for 1906, and he had unsuccessfully been trying to reconcile that statement with the other figures given, *i.e.*, an output of 180,000 units, and a maximum load of 150 KW., which worked out to a load factor of only 13 per cent. A cost of ·875d. per unit on the load factor of 40 per cent. was certainly high. Most supply undertakings would be prepared to quote a much lower rate than ·875d. with such a good load factor. In the author's case it might have been worth while to consider the use of a fairly large battery to level out the peaks of the load caused by pumping. At Birmingham they were using small broken granite for filtering material, whereas it was quite the usual practice to use screened clinker for the bacteria beds. He thought the pumping efficiency of 68 per cent. given by the author was a very good figure for the ordinary commercial centrifugal pump. He was surprised to find that arrangements had been made for running the private generating plant in parallel with the public supply; he considered such a course very objectionable.

Mr. A. B. Mallinson said that at Burslem the effluent was lifted from the levels by low-lift turbine pumps and distributed over 14 120-ft. electrically operated revolving spreaders. The power was taken by means of an overhead line from the town supply, there being about 25 motors totalling 160 H.P. At Huddersfield a large plant was started about 2½ years ago. There the sewage settling tanks, &c. were about 1½ miles from the spreaders, the sewage flowing by gravity along an open culvert. The spreaders took very little power under normal weather conditions, but the load would easily be trebled due to wind pressure in a gale. At Huddersfield there was a fairly large gas-driven electrical plant, which supplied, in addition to the spreaders, the air compressors, &c. The power to the spreaders was taken by an overhead line along the line of the effluent culvert. Both of these installations dealt with the whole flow of the sewage from the towns. He knew of cases where electrolytic action had been a prolific source of trouble with sewage water.

Mr. A. G. Cooper noticed that the storm water was apparently a large amount; in Colne, in all the new streets, surface water drains were now laid and connected direct to the river, so that they had to deal with so much less water on the filter beds.

Mr. W. B. Shaw said the author mentioned the drop in line as being 12 per cent., although the line was designed for 7½ per cent.; it looked as though the higher figure actually obtained might be accounted for by the reactance. With regard to squirrel-cage motors and their end rings, he had a case some little time ago where the motor actually refused to start without load, even with 60 per cent. of the line voltage. The motor was disconnected from the pump entirely and was perfectly free in its bearings. It was not until a saw cut had been made in each end ring of the motor that the latter would start. When that was done it started up quite normally. With regard to running in parallel with public supply mains, unless precautions were taken with regard to the excitation of the generators in the pumping power station, it would be possible to compel the public mains to supply practically all the magnetising current, a state of affairs to which the Corporation engineer would probably object. He agreed with the author's recommendation that the pumps should be filled with water before starting up; it was practically impossible to get the pumps away if the filling was left until after the pumps had been run up. For the same reason, also, the arrangement sometimes adopted for priming the pump by letting water back into it from the pressure main was unsatisfactory. A great deal of time could be wasted in starting up centrifugal pumps by not going about it in the right way.

Mr. Mountfort in reply, said that there was no trouble in cleaning the filters. They were constructed of metal screens with holes about 1-in. diameter. The whole of the sewage was not dealt with. The bulk was dealt with by gravitation. The pumps were ordinary centrifugal pumps, and not high-grade turbine pumps. The question of first cost was of more importance in this case than efficiency of operation, and he therefore thought the figure obtained, viz., 68 per cent., was a good one for that particular form of pump. With regard to the periodic fluctuations in the curves due to split end rings, if a motor had the end rings split, it practically made it into a single-phase winding. Each time the winding slipped past the pole, fluctuations occurred in the rotor current. The figure given in the paper on the demand upon a central station being from 5 per cent. to 10 per cent. of the entire output, related to cases where all the sewage had to be pumped, but in Birmingham a great deal of it was dealt with by gravitation, and did not need power. The peaks sometimes lasted for two or three days, and the battery would be an expensive piece of apparatus if it was to fulfil that function. A granite filter would probably last 20 or 30 years, but a clinker medium tended to pulverise or break down in a much shorter time. With regard to running the private plant in synchronism with the public supply, the latter had raised no objection; he knew it was not often done, but if anything went wrong in this case, he thought the private plant would suffer the most. They had experienced a lot of trouble through the accumulation of snow on the horn type of arrester, but the provision of expanded metal hoods had stopped the trouble. He did not intend to say that they kept the rain out. The air-gap in the horn arresters was ⅛ in. He was of the opinion that the spray jet method of distribution was better than the system of rotating arms. In the former case the whole of the effective area of the bed could be utilised irrespective of shape.

Extra-High-Tension Transmission Lines.

(*Discussion before the* Institution of Electrical Engineers *at Leeds, February 15th.*)

Mr. W. B. Woodhouse said the real difficulties of overhead line construction in densely-populated countries were not touched on in Messrs. Matthews and Wilkinson's paper; frequent road crossings, deviations to avoid the land of owners who would not grant wayleaves, railway and telegraph crossings, all presented greater difficulties than the design of a cross-country line where angles could be avoided and obstructions were few. Wooden poles were hardly a thing of the past. The adoption of split conductors to reduce the impedance advocated by Mr. Taylor seemed the first step towards a network of interconnected lines such as was used in this country for 10,000-volt work. The most difficult problem on lines transmitting large amounts of energy was that of control and switching; operation difficulties increased very rapidly with an increase of current, and greater security might often be

obtained by increasing the voltage and decreasing the current. The benefit of the so-called flexible structure was apparent when the stresses were considered for wires firmly fixed to the insulators, but with the adoption of the suspension insulator the need for a special consideration of flexibility disappeared. The use of suspension insulators seemed to be a step in the right direction, but they had not yet come to the final type of insulator. Many of the designs shown were much too heavy, and mechanically defective in that if the insulator broke the line would fall; these were serious faults. He had for some years used suspension insulators for securing safety in road crossings, and found them satisfactory.

MR. T. HARDING CHURTON said that the question of the overhead transmission of electrical energy at high pressure was one of growing importance; popular prejudice must be overcome, and public opinion created that would prevail upon the authorities to grant increased facilities for the construction of overhead lines. The powers of veto which local authorities enjoyed should be modified. With regard to the spacing of the wires, he was surprised to notice how close together the lines of the Yorkshire Electric Power Co. were: though this might be an advantage as regards inductive drop on the line, there must be considerably greater risk of short circuits. With regard to lightning, when he was in Montreal last summer, a terrific lightning storm was experienced. The city was supplied with power from three separate hydro-electric stations at distances varying from 30 to 60 miles. The power lines were struck 15 times during the storm. On 12 occasions the horn lightning arresters prevented damage: on two occasions part of the town was thrown into darkness momentarily, and on another occasion for about 15 minutes before the fault could be located and the supply resumed. He was informed that power lines operating at 100,000 volts did not suffer from lightning nearly as much as the lines operating at lower voltages, the explanation being, he believed, that the high-voltage lines were necessarily so well insulated.

MR. B. WELBOURN said he had been making inquiries as to the probable life of poles to be expected in England, and there was good reason to believe that properly creosoted poles would have a life of 30 years, and it might be 50 years. From what they knew of the pitting of steel tramway poles at the ground line, they would be well advised to avoid the use of flexible steel towers in this country until they know more about their behaviour in the English climate. He could give some figures for the very best pole line construction in this country at the present time:—A single-circuit 20,000-volt three-phase line transmitting 5,000 K.V.A. costs £800 per mile. A double-circuit line for 10,000 K.V.A. would cost about £1,250 per mile. With underground cables where it would be necessary to put in duplicate 20,000-volt three-phase feeders, and including the cost of street work, it would run to about £3,500 per mile forward—each cable would carry about 5,000 K.V.A. regularly. The general English practice was not to use the overhead ground wire except underneath the power wires, and there it was sometimes used as a catenary wire to support lead-covered telephone and pilot wires and for grounding the ironwork in the event of a fault occurring on an insulator. Those who had tackled this question of earthing found it an extremely difficult problem in England. The American "Load Despatcher," who looked after the whole system, was called in England the "System engineer." In New York the business-getting department was referred to as the "Hot-air department."

MR. FARRAND said that, as a Post Office engineer, his experience was that the life of creosoted poles in England in favourable circumstances was 30 to 35 years, and in unfavourable circumstances something like 20 years. In many cases poles that had been in since the early days of Post Office telegraphy in 1872, had been found perfectly sound. The difficulty appeared to be in England that if poles were put in sand or porous material they rapidly deteriorated in the ground, because the creosote ran out and was absorbed by the ground; if they were put in wet or clayey ground they stood indefinitely, as the creosote ran down from the top of the pole and formed a bath at the foot.

PROF. PARR asked whether the 7,000 K.V.A. load mentioned in Mr. Taylor's paper was entirely an "apparent" load, and with regard to the type of suspension insulator shown, whether there was not a considerable amount of chafing due to the action of the wind in drawing the cable backwards and forwards through the sleeve.

MR. F. THURSFIELD said he was struck with the great number of switches provided for different cross-connections, &c. In one diagram there were no fewer than five switches in series on each incoming line before they got into the sub-station. In the case of one of the large water-power stations, by adding together the first four items, viz., dams, pipe lines and tunnels, power station equipment and buildings, he got a figure of £2,220,000, which worked out at £60 per KW. for the power station alone. Some reduction might possibly be needed for spare plant in this case, but evidently the problem of supplying power on a large scale in this country was a much more simple matter, where they could provide generating stations for £12 or £15 per KW. Ten per cent. interest on £60 per KW. came to ·4d. per unit, with a ·4 load factor. It this country the corresponding charge would be perhaps $\frac{1}{10}$d., leaving ·3d. to cover fuel and other extra working costs. Whatever the capacity of the power station was, it was clear that two-thirds of the whole annual expenditure was interest on the power plant only.

DR. POHL said that Mr. Taylor's explanation for the well-known fact that each added unit raised less than proportionately the flash-over voltage of the combination did not appear to be the correct one. Quite generally for any class of insulating material the breakdown voltage per unit of length decreased with an increase of the total length subjected to the test, and the reason lay primarily in the unequal distribution of the electrostatic stresses. He believed, in the case of insulators of the kind under consideration, the ionisation of the air due to silent discharges which preceded the actual flash-over was of considerable importance in determining the flash-over voltage. Mr. Taylor stated that it was the complication of the high-voltage D.C. system which stood in the way of its universal adoption; to his mind, if there was a point which favourably distinguished the Thury constant-current system more than any other it was its extreme simplicity. The true reasons why that system had not made more rapid progress appeared to be the greater cost of the generating plant, which balanced the proportionately large saving in the transmission line, except in cases where the expense of the latter played a very great part in the total cost of the scheme, and, secondly, the constancy of the c^2R losses. With regard to the first point, the advance in the design of D.C. machinery had solved the problem of constructing large high-tension D.C. dynamos at reasonable cost, and to the C^2R losses they must surely get reconciled, when they heard from Mr. Taylor in connection with three-phase lines of leakage and corona losses amounting to 1 KW. per mile and of charging currents corresponding to 20,000 K.V.A. It seems to him, after reading these papers, that the prospects of the Thury system for long-distance transmission were even brighter than he had previously thought them to be.

MR. CHRISTOPHER WADE (communicated).—For voltages so far used, and conditions in this country, where there were not very long clear runs, wooden poles had been and were being successfully used. Their strength had been amply demonstrated by tests they made a few years ago, also G.P.O. tests, &c., and their durability, when properly creosoted, was shown by the number in use for all purposes in this and other countries. The average life of steel towers might be 30 years, but this was only attained by continual painting. The average life of properly treated wooden poles was 25 to 30 years. Wooden poles were considerably cheaper than steel ones of equal size or strength, and the cost of an overhead line run on wooden poles was only a fraction of that of a similar underground line.

MR. G. GILLETT also gave a longer life to wooden poles, and noted with surprise that it was the practice to run telephone circuits on the towers carrying the high-tension circuits. In this country they would have great difficulty in getting men to attend to those circuits. The practice in this country was to run covered telephone wires when crossing power circuits.

MR. J. F. C. SNELL, in reply, said: The chairman referred to the relative cost of overhead lines and underground cables, and Mr. Welbourn gave some interesting figures on this point, stating that single overhead line construction would cost £800 per mile. Knowing the approximate cost of the pole line, I take it that that really represents about £1,200 for a double line, each line carrying the same load. The ratio of underground cable to overhead line cost for equal transmission facilities is, therefore, practically as three to one. That, I presume, refers to 20,000-volt line, a good deal of which has been constructed by him on the North-East Coast. The point is that the copper is practically the same, and it simply becomes, therefore, the relative costs on the one hand of the poles and wayleaves in this country as against the cost of trenching, insulation and jointing of the cables. With regard to the chairman's remarks respecting the storm at Montreal, I take it he was referring to a line where they have single insulation. I understood him to say the voltage was 60,000. The same effect, of course, would not have happened with the suspension type of insulator. As Mr. Woodhouse mentioned, these very high pressures do not apply, and perhaps never will apply in this country. As I remarked, however, we must, as engineers, take an active interest in this high-tension transmission, because many of us may be called upon to carry out schemes in other countries. At the present time I am connected with a 50,000-volt system in New Zealand. I have not yet had any experience, but have to gain it, and we are very much indebted to our American brethren for the information they give us. The interesting remarks of Mr. Farrand with respect to the life of wooden poles represent, I believe, the general experience of his department, viz., an average life of 35 years. Where the author speaks of a general life of 12 years, it must be remembered that he refers to American, and particularly Californian practice, and he is probably referring to different kinds of wood, which would affect the life considerably. Perhaps also they are untreated poles, being cut down and erected *in situ*. I cannot say how the grounding is carried out, but the author relies on carrying the steel tower below the bed of concrete, and some extra earth plates may be fixed where necessary. Mr. Thursfield referred to the number of switches. They are isolating switches, and are necessary to enable the oil-break switches to be completely cut out for examination and repair. He also referred to the high cost per kilowatt in Table II, which works out at £40 per kilowatt. I should imagine, as Mr. Matthews pointed out, that Mr. Taylor was probably referring to his own Mexican system, which is a plant of 75,000 KW. In any case, in comparing the price, we must bear in mind the chairman's remarks that the cost of material is about double over there to what it would be in this country. The capital charges are the principal charges in all large hydro-electric schemes. With reference to Dr. Pohl's remarks on the flash-over at 90,000 volts, I think he has misread the author's remarks. As I read it, it means that while you test each insulator separately and get 90,000 volts, if you put four of these in series you will not necessarily get 136,000 volts, but something less. The Metropolitan Electric Supply Co. in this country is actually going to install a system of direct-current high-tension transmission from the Willesden power station. I am not sure whether it is yet actually

constructed, but we shall have a high-tension D.C. system in this country within the next few months.

MR. R. BORLASE MATTHEWS, in reply, referring to the comments made by several speakers on the life of wooden poles, upheld the statement made in the paper as to the comparatively short life of the special class of pole used for this work. This was also the result of the experience of the United States Department of Agriculture, which had investigated the subject very carefully. Italian engineers had found the life to be even shorter. American engineers had had a good deal of experience with galvanised iron towers—no appreciable deterioration being apparent after 20 years' service. Painted towers were not likely to have such a long life as the galvanised type, and they required repainting every three years or so. The question as to whether star or delta connection was the better had not been definitely settled; but the best practice pointed to the adoption of the delta method. The telephone companies preferred the latter, as in the case of a star connection there was a liability to unbalancing if a fault occurred, and the resulting earth currents disturbed the telephone lines. When a fault occurred on one phase of a star system the two other phases might for a short time be subjected to a voltage to earth nearly equal to the full line voltage. Hence economies could not be effected in the insulation of the line. The advantages of earth wires had been queried, but extended experience had proved their value. Serious difficulties in the operation of some long lines in the South of France had been overcome by their adoption, as the result of recommendations made by the authors.

PARLIAMENTARY.

Metropolitan District Railway Bill.

(*Concluded from page* 379.)

THE CHAIRMAN asked what other work the Underground Co. did besides supplying the electricity.

MR. FITZGERALD said the Underground Co. held shares in the Metropolitan District and the London Electric Railways Co.

The CHAIRMAN asked whether the Undergound Railways Co. would be wound up if the powers sought in the Bill were acted upon.

MR. FITZGERALD said that that did not follow, for they would continue to hold stock in the railway companies so long as they considered it desirable to do so. He ought also to have mentioned that the Underground Railways Co. were also largely the owners of the London United Tramways Co., which was worked in connection with the Tube Railways. It was proposed by the Bill that after the Joint Committee had purchased the power house they were to grant a lease of it to the two railway companies for a term of 999 years, at a rent which would be equivalent to the interest on the power house stock which the Joint Committee would have power to issue for the purpose of raising the purchase money and all other expenses of the Joint Committee. This rent was to be paid by the two companies as a working expense, the effect of this being that it became a prior charge on the two companies before even the debenture interest, and would have the effect of enabling the stock to be issued on the best possible terms. Then there were clauses in the Bill enabling the two companies as lessees to work the power house and to appoint a working committee for that purpose. The two companies would, of course, pay rent according to the amount of electricity they received from the station.

The CHAIRMAN asked what the profit was which the two railway companies had to pay to the Underground Co. under the existing agreement.

MR. FITZGERALD said it worked out at '03d. per unit supplied. The basis for agreement regarding the purchase was as follows:—The Joint Committee would first pay 25 years' purchase of the 5 per cent. they now paid on the cost of the station; and, secondly, 25 years' purchase of the profit he had named, viz., '03d. per unit supplied. There were two other proposals in the Bill which still remained in a modified form. Originally there was a proposal with regard to supplying other companies and supplying in bulk. The capacity of the Lot's Road station was considerably in excess of the requirements of the two railway companies, and it was a station admirably situated for giving a cheap supply of electricity, and had been laid out for giving a supply to traction companies in the best possible way. The two railway companies already had powers to supply a number of other railway companies, and were actually supplying two at the present time. The original proposal was to authorise the two railway companies to supply other railway and tramway companies, to supply in bulk to authorised undertakers, and to supply their own tenants throughout their area with electricity. Great opposition had been forthcoming to these proposals, and especially in regard to the last two. They were objected to by the whole of the electrical supply companies of London and by the various local authorities who had electric undertakings. Negotiations had taken place with the result that the original clause (No. 23) had been struck out and a new clause substituted. In this the power to supply in bulk and to supply to the tenants of the two companies had been eliminated altogether. The new clause would enable the two companies to supply to the Metropolitan Railway Co., the London and South-Western Railway Co., the Whitechapel and Bow Co., the London, Tilbury and Southend Railway Co., the Wimbledon and Sutton Railway, the Great Western and Metropolitan Companies, the Edgware and Hampstead Co., the Watford and Edgware Railway Co., the Great Northern Railway Co., the Central London Railway Co., the City and South London Co., the Great Northern and City Railway Co., the London and North-Western Co., and the North London Railway Co. With the exception of the last five named companies, either the Metropolitan District or the London Electric Railways Co. already had power to supply to the others.

SIR R. BAKER (a member of the Committee): Do I understand that if this Bill passes your two railway companies will become the monopolists for supplying all these other railways?

MR. FITZGERALD: No; the other railways are under no obligation to take power unless they like.

The CHAIRMAN: And do they now supply any others?

MR. FITZGERALD said they were supplying the London and Tilbury Railway and the London and South-Western Railway.

The CHAIRMAN: You told us that the Underground Co. was supplying them.

MR. FITZGERALD explained that these railways were supplied through the Metropolitan District Railway, although the current was generated at Lot's Road. The current must be supplied over the mains of either of the two railway companies, because the Underground Co. had no power to break up the streets to lay mains. That, in fact, was one of the advantages of giving the power of supply to a railway company; because it did not mean interfering with the streets. The Central London, the Great Northern and City, and the City and South London Railways had each got generating stations of their own, and they asked for powers to give them a supplemental supply should they require it. Then the clause enabled the two companies to supply to the London and North-Western Railway Co., the North London Railway Co., or any other company owning a railway or tramway, in regard to which either of the two companies had through arrangements, or had authority to form a physical connection.

The CHAIRMAN asked if the London and North-Western Railway Co. had got powers to work electrically.

MR. FITZGERALD said the company had powers to construct a line to Watford to be worked by electricity. But, in addition to the modified clause, the promoters had also entered into various agreements with those who were opposing the Bill. At the present time the London Electric Supply Co. was supplying current to the London and Brighton Railway for the working of some of their suburban lines, and the promoters had undertaken not to tender against the London Electric Supply Co. in respect of the London and Brighton Co. They had also entered into a similar agreement with that company in respect of their supply to the South-Eastern and Chatham Companies. In modifying Clause 23, and in making these agreements, he maintained that the promoters had made a very big concession, but they had done so in the interests of peace, and to avoid an expensive contest. As a result they had satisfied all the electric supply companies except one, viz., the Metropolitan Electric Supply Co., who had a generating station at Willesden, and who, although they were not authorised to supply in Willesden, seemed to think they had a presumptive right to supply the London and North-Western Railway Co. He suggested that the Metropolitan Electric Supply Co. never could supply that company because the two essentials of water supply and cheap coal for the generating of cheap electricity did not exist at Willesden. Mr. Fitzgerald proceeded to deal with the other powers sought for in the Bill for running omnibuses and making certain small lines at Earl's Court.

MR. ALBERT H. STANLEY, the managing director of all the three companies concerned in the Bill, gave evidence, and said the purchase money for the power house would be payable in stock. The precise terms of purchase had not yet been agreed upon, but it had been agreed that the financial obligation on the two railway companies would not be greater than it was now.

MR. ROSKILL: Whatever financial burden now rests on the two railway companies will not be increased by this purchase?—That is so.

Replying to the CHAIRMAN, the WITNESS said the doubling of the power to supply in bulk would not greatly affect them. There was much more capacity in the Lot's Road station than was originally anticipated, because it was designed for reciprocating engines, but the Parsons turbines came in and did not take up so much space. As to the power sought to supply the tube railways, which had their own generating stations, it had to be remembered that the tube railways were not in a very good position, and they would have difficulty in raising large sums of money. As they expanded they would require more power, and the promoters wished to be in a position to give that supplementary supply.

Cross-examined by MR. VESEY KNOX (for the County Council), WITNESS said he saw no reason why they should submit the agreement for the approval of the Board of Trade because it was entirely a matter for the shareholders, and the railway companies would not be under any greater financial obligation than they were at present. The present agreement provided for periodical revision of the terms, but he did not think the two railway companies could ever expect to get a reduction. The profit to the Underground Co. now was £16,000 a year, which capitalised at 25 years' purchase meant £400,000.

Questioned as to what was to become of the depreciation account, WITNESS said at present it was about £160,000, and the agreement provided that whatever the value of that fund might be in 95 years' time, when the present agreement expired, it should belong to the Underground Co. He believed the value was placed at £30,000. The expenditure on the Lot's Road station was £1,500,000, and 5 per cent. on that capitalised at 25 years' purchase would be £375,000. The Underground Co. would get the capital expenditure of £1,500,000, the 25 years' capitalised 5 per cent., and the 25 years' capitalised profit.

MR. VESEY KNOX, K.C., for the County Council, called for the

production of the existing agreements between the Underground Co. and the Metropolitan District and London Electric Railway Co. as to the price now paid for current, and MR. FITZGERALD agreed to produce them.

Subsequently the CHAIRMAN said the Committee saw no reason why these agreements should be produced. So long as there was no suggestion of anything in the nature of a swindle, the Committee did not feel that the County Council need raise the matter in detail.

MR. BALFOUR BROWNE, on behalf of the Metropolitan Electric Supply Co., said they had been having certain negotiations with the promoters, and as it was possible they might come to an agreement, he would not cross-examine Mr. Stanley.

MR. SYLVAN MEYER cross-examined on behalf of the Battersea Borough Council, and WITNESS said he was not aware that the Borough of Battersea supplied the whole of the London and South-Western Railway Co.'s good yards at Nine Elms and their sidings at Clapham Junction with current for lighting and also with power for their lifts and signals, or that the Borough Council derived an income of £3,000 a year from that source. He was also not aware that the Borough Council supplied the Great Western Railway Co. with lighting, from which they derived an income of £1,000 a year. The promoters did not propose to ask for any rights with regard to that.

Witness withdrew on the understanding that he would be recalled.

MR. C. H. MERZ next gave evidence, and said that the undertakers had recently modernised the plant at Lot's Road and had installed eight large Parsons turbines of 6,000 and 8,000 KW. The existing plant was capable of doing a great deal more than it was now called upon to do. At present the output was 157 million units per annum, but there was capacity for producing 500 million units. That would be an appreciable proportion of the total requirements of the railway companies in London. Probably, in the comparatively near future, the suburban railways of London would require something like 1,000 million units.

MR. FITZGERALD, on the resumption of the proceedings, said that the Metropolitan Electric Supply Co. had not yet arrived at an agreement, but they hoped to do so, and would withdraw from that Committee without prejudice to their rights in the other House. As the result of his conference with Mr. Vesey Knox, they had considerably reduced the points in controversy between the promoters and the County Council. The promoters had tendered a clause which the County Council had accepted, viz., "That the terms of purchase and lease of the generating station shall be such that the revenue burden upon the two companies shall not be greater than they would have been if the Bill had not passed." This left only two points between the County Council and the promoters. He understood that the Council were objecting to any power being given to supply railway companies, which the promoters had not already power to supply, unless with the sanction of the Board of Trade. The other point was that the County Council wished to curtail the companies' powers with regard to the extension of the Lot's Road station.

The CHAIRMAN asked if they were taking any new powers for extending the station.

MR. FITZGERALD said they were quite content with their existing powers, and if they wanted new powers they would have to come to Parliament, and then the County Council could raise objection.

MR. VESEY KNOX said that so far as the point of capitalisation was concerned, they were content with the undertaking of the promoters. Their only object in intervening in the matter was in the public interest, and to see that no undue burden was placed upon these undertakings. Although they recognised that the capitalisation on the present revenue gave a certain profit to the Underground Co., still they would be content with the undertaking that the burden upon the two companies should not be increased. They preferred not to go into details as to how the price was to be arrived at, but would take the undertaking in the general terms which had been read out. Having regard to their powers of purchasing the existing supply companies in 1931, the County Council thought that so far as regarded the railway companies which the two companies had not already power to supply, these should not be supplied without the consent of the Board of Trade. As to the extension of the generating station, he did not think there was really much disagreement in principle. The County Council were, of course, quite ready to admit that so far as there were at present legal powers existing to enable the company to extend their generating station, they had no right to ask that these legal powers should be curtailed on the occasion of the transfer, but in the filed Bill there were words which suggested that extensions might be made beyond the existing powers of the company.

MR. MERZ, cross-examined by MR. VESEY KNOX, said that with the existing accommodation at Chelsea they could put in machinery to raise the kilowatt capacity from 48,000 to 180,000.

MR. VESEY KNOX asked whether, supposing it came to an amount beyond 180,000 KW., it would not be more profitable to have a great generating station on the river lower down.

WITNESS said this would depend entirely on the size. He agreed that if they had to supply another quarter of a million kilowatts it would probably be a mistake to extend the Lot's Road station.

Questioned as to whether it was not desirable that ultimately the railway and lighting and power loads should be under one supervision, WITNESS said that would entirely depend on what body it was.

I put it as an engineering matter that one purveyor would be better able to deal with it?—I cannot answer that without knowing who the body is to be

Under the modified Clause 23, is there any railway in London which you could not supply?—I don't know whether we could supply all, but we could a large proportion of them.

MR. SYLVAN MEYER, on behalf of the Battersea Borough Council, asked Witness whether he would be prepared to leave that Council to supply the London and South-Western Railway lighting at Nine Elms, and the Great Western Railway.

WITNESS pointed out that there was nothing to prevent those companies from going where they liked.

MR. STANLEY was recalled, and said the promoters already had power to supply the London and South-Western Railway with current for light; but they were not seeking power to supply the Great Western Railway within the Battersea area.

MR. CORTEZ LEIGH, electrical engineer to the London and North-Western Railway Co., gave evidence in support of the Bill, and said the authority given to supply his company would be a convenience to them if they wanted a supply for their Watford line. His company did not pledge themselves to take any supply.

MR. SELBY, manager of the Metropolitan Railway, and MR. JENKIN, general manager of the City and South London Railway, each gave evidence concerning the advantage it would be that companies now generating for themselves should be able to supplement their supply.

MR. MEYER addressed the Committee on behalf of the Battersea Borough Council, and pointed out that that authority had spent £300,000 in connection with its electric power station, and had entered into contracts with the London and South-Western Railway Co., and it would be a great hardship if they were deprived of their small profit.

MR. BOND, electrical engineer for the Battersea Borough Council, gave evidence as to the cost of generation.

Questioned by MR. FITZGERALD as to whether he thought the two railway companies should be deprived of their present rights of supply, WITNESS said he did not agree that the Metropolitan District Railway had power to supply to the London and South-Western Railway. If they did have the right, he thought it would be a good thing if it were taken away.

MR. VESEY KNOX addressed the Committee on behalf of the London County Council, and pointed out the huge general powers which were asked for by the promoters. They were asking to supply all the railways in London, without any supervision. He urged that any such powers should be subject to the sanction of the Board of Trade.

On Thursday, March 9th, MR. FITZGERALD, K.C., replied on behalf of the promoters. He said the opponents had treated the case as if there was something objectionable or contrary to public policy, or to the practice of Parliament, in one railway company giving a supply of electricity to another. There was no foundation of any kind for that suggestion. There were numerous cases where powers had already been given to the railway companies he represented, which were a sufficient answer to that suggestion, but further than that they would find no decision of any Committee stating that it was against public policy to allow one railway company which had got a generating station to supply electricity to another railway which had no generating station of its own. So far from there being any objection to such a course, it was obviously a most desirable thing to do in the public interest, because everything that enabled a railway company to do its work economically was for the public advantage. If they had a station like Lot's Road, it went without saying that from a station of that sort, with a larger output, they could give a supply more economically than from a small station. There was this further point, that this policy of amalgamation would stop the multiplication of generating stations. There was always thought to be a nuisance from a generating station, and, therefore, if from one station they could supply half-a-dozen or a dozen railway companies instead of having a separate station for each, they certainly minimised that objection of nuisance, whether it was real or sentimental, by concentrating the nuisance if, there was one, on the spot.

MR. SYLVAN MEYER said his contention was that there was no precedent for a railway company coming in and taking power to give a supply which a Corporation was empowered to give under an Act of Parliament.

MR. FITZGERALD said his friend was asking the Committee to strike out of the Bill the powers which the promoters already had of supplying electricity to the London and South-Western Railway.

Replying to an observation from the CHAIRMAN, MR. FITZGERALD said it would be very uneconomical if these tube railways in London were to take their power for traction from one source, and their supply for lighting from another. At present they had the power to take their combined supply from one source, and he submitted that it would be most unfair to deprive them of that power.

After consulting in private, the CHAIRMAN announced that the Committee found the preamble of the Bill proved.

COUNSEL representing the L.C.C. and the Islington Borough Council intimated that they did not propose to go into clauses in this House.

MR. S. SANKEY, for the gas companies, proposed the following new clause (1): "Notwithstanding anything contained in this Act, the two companies shall not supply from their generating station at Lot's Road electrical energy (1) in bulk to any undertakers for the purpose of supply or distribution by such undertakers, or (2) directly to any consumer not being a railway or tramway company, or (3) to any railway or tramway company specified in paragraph (*a*) or paragraph (*b*) of Sub-Sec. (1) of this section of the Act, of which the marginal note is 'As to supply of electrical energy,' for any purpose for which such supply is not expressly authorised by an existing Act to be given, or (4) to any Corporation specified or referred to in paragraph (*c*) of the said section for any purpose not expressly authorised by that section with reference to such company." (2) "No railway or tramway company shall use any electrical energy supplied to them

by the two companies for any purpose for which the two companies are not authorised to supply the same."

Mr. Fitzgerald intimated his inability to accept Mr. Sankey's proposed clause, but he expressed his willingness to put in a new clause to the effect that none of the statutory powers in connection with and relating to the generating station of the Underground Co. should be taken over. He said that the gas companies sought to interfere with the supply of electricity whenever they could, so as to try and make people take gas instead of electricity. The electric supply companies, who were the persons most interested in the matter, inasmuch as it would be competitive with their supply, were not asking for any alteration.

Mr. Sankey said it was clear that the promoters wished to introduce something by a side wind in their clause, otherwise they would accept the clause he had put forward.

The Chairman intimated that in the opinion of the Committee the clause proposed by Mr. Sankey went too far, and they were quite satisfied with the undertaking of Mr. Fitzgerald.

The remaining clauses were then gone through, and the Bill was ordered for report to the House.

London Electric Railway Co.

On Thursday last week, the Bill promoted by the London Electric Railway Co. came before a Select Committee of the House of Commons, presided over by Mr. Walter Guinness.

Mr. Fitzgerald, K.C., who appeared in support of the Bill, explained that it was promoted by the London Electric Railway Co., and had for its main object the construction of two short pieces of line in extension of their existing system. At the present time, the company owned 22¼ miles of tube railway, it had a capital of £16,800,000, and its public usefulness might be estimated from the fact that last year it carried in round numbers 101 million passengers. At the present time, the terminus of the Charing Cross, Euston and Hampstead line was in the station yard of the South-Eastern Co., and there was no physical connection between that station and the Trafalgar Square station of the Bakerloo Railway, or the District station at Charing Cross. It was proposed to make a loop there which would enable the traffic to be worked much more satisfactorily and at the same time would give a connection between the stations he had mentioned. That short extension would be a great public convenience, and all opposition to it had been withdrawn. The other new line was to commence at Edgware Road, and to be carried on for about half a mile, terminating under Paddington Station of the Great Western Railway. There would be communication with that station by means of lifts. The Bakerloo Railway had the greatest density of traffic of all the London railways, and it would be a great public convenience to carry it on to Paddington. As long ago as 1900 Parliament authorised the extension. Again in 1906 a deviation of the extension was authorised, but the company were not then prepared to go to the expense of construction. Paddington had one of the largest passenger traffics of any of the terminal stations in London. Fifteen million passengers used the station in the course of a year, and about 8½ million of those passengers were going to or from other stations within 30 miles of Paddington. It would, therefore, be a very great convenience to the public to have the Baker Street and Waterloo line extended to Paddington, as at present it involved a walk of half a mile. The only opposition came from the Metropolitan Railway Co., who were opposing on the ground of competition. He believed, however, that the real opposition was not to the Bill now before the Committee, but because they feared that the line might in the near future be carried further and thus become a competitor with them on their several lines.

Mr. Stanley, the managing director of the promoting company, gave evidence in support of the Bill, which, he said, would involve an expenditure of £215,000. The proposed extension had been approved by the Royal Commission on London Traffic.

On Friday further evidence was given in support of the scheme by Mr. Charles Aldington, the superintendent of the Great Western Railway Co. He said that that company was prepared to contribute £18,000 towards the expense of the line, which it was very anxious to see constructed.

In cross-examination, the Witness absolutely denied that in supporting the scheme his company was infringing the agreement which was made in 1865 between the Great Western and the Metropolitan Companies, by which each undertook not to take any action which would prejudice the other's interests. He contended that the proposed line would not detract from the Metropolitan traffic in any way.

The Chairman intimated that the Committee did not wish to hear any further evidence as to the desirability of the line, as they were quite satisfied that it was in the public interests that it should be constructed. They would, however, be willing to hear any evidence which the Metropolitan Railway had to bring forward on the question of competition.

Mr. Selby, the general manager of the Metropolitan Railway, was then called, and stated that, in his opinion, the proposed extension would very seriously affect both their local and through traffic. In view of the agreement entered into between the two companies in 1865, he did not think the Great Western Co. was treating them fairly in supporting this scheme and giving it financial support.

Counsel having addressed the Committee against the scheme, the Chairman announced that the Committee found the preamble proved, and the Bill will be reported to the House for third reading.

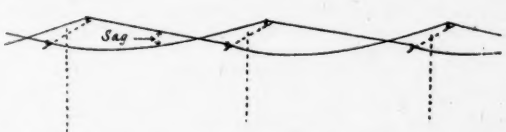
Kingston-on-Thames Bridge.—On March 7th this Bill came before Sir H. Samuel's Select Committee of the House of Commons, the object being to vest the bridge in the County Councils of Middlesex and Surrey, and to widen and improve the bridge and approaches. Sec. 9 provides that the London United Tramways Co., at their own expense, shall, when required, remove their existing tramway on the bridge, and shall relay it to the satisfaction of the County Council's engineer. By Clause 44 the Tramways Co. are required to pay £10,000 towards the cost of the improvement. The only opposition came from the Metropolitan Water Board, and the Committee found the preamble proved, and ordered the Bill to be reported for third reading.

Southampton Corporation Tramways.—The Bill promoted by the Southampton Corporation for the construction of several short sections of tramways came before the Committee on Unopposed Bills, presided over by Mr. Emmott, on Wednesday last week. Mr. Pritchard, for the promoters, said the two objects sought to be attained were the construction of additional tramways and to enable the Corporation to acquire additional lands and extend one of its tramway depôts. Mr. Crowther, borough engineer, was called, and in reply to the chairman, said the cost of a single track was £2,750, and of a double track £5,450; and the paving for a single track cost £2,700, and for a double £5,400. The Committee passed the preamble of the Bill.

Telephone Contracts.— Mr. O'Grady asked the Postmaster-General whether contracts for telephone work were still being placed with the Peel-Connor Co., of Manchester; whether he was aware that the firm had continually violated the fair wage clause of Government contracts; if any inquiries had been made in the matter; and what steps would be taken to ensure the due observance by this firm of the terms of the fair wage clause.—Mr. Herbert Samuel replied as follows: I have made inquiry into the allegations made against the firm, but the point in dispute raises a question of some difficulty, and a further investigation is necessary and is about to be made. I will communicate shortly with the hon. member with regard to the matter.

Western Valleys (Monmouthshire) Railless Electric Traction Bill.—The Standing Orders Committee of the House of Lords decided on Friday not to dispense with the standing orders in the case of the Western Valleys (Monmouthshire) Railless Electric Traction Bill, under which it was sought to incorporate a company with a capital of £60,000, and to install a service of railless tramways. The promoters failed to comply with the standing orders by omitting to state in the newspaper advertisements their intention to generate and use electrical power. The Bill accordingly drops.

Transposing Telephone Wires.—A simple method of transposing a pair of telephone wires at every pole of the transmission line along which they are carried is described in the *Electrical World* by Mr. P. F. Larned. The method consists in crossing the wires between the poles, allowing the lower wire several feet more sag than the other. In a line carried on pins 3 ft. apart and hung in 600-ft. spans, 3 ft. difference in the sags of the crossing wires has proved an entirely satisfactory and permanent construction. The wires cannot swing together and make



Transposing Telephone Wires on Transmission Towers.

contact, for at the middle of the span, where the tendency to swing is greatest, the wires are correspondingly most widely separated. In a line of any length the unsymmetrical suspension of the wires is compensated, since each wire occupies alternately the long and short sag position. The only provision to be made in using this construction is that the wires do not slip on the insulators or the latter rotate under the unbalancing action of the unequal spans letting the wires get together.

Ampere-Hour Meters for Controlling Electroplating.—The amp.-hour meter can be provided with a scale marked in pounds of copper, ounces of silver, or units of any other plating metal, so that when the meter is placed in series with an electroplating bath the exact quantity of metal deposited can be read directly without examining the plated piece. The amp.-hour meter hand is arranged with a set-back attachment so that it can be started from zero at the beginning of each plating operation. Several large silver-plating concerns which have had amp.-hour meters in service for a year or more report that with the large batches of work in their electroplating baths the reading of the meter has attained an accuracy over 99·5 per cent. of the actual deposits by weight. A contact piece on a movable hand makes it possible to operate a circuit-breaker and stop the plating operation after a given weight of metal has been deposited.—*Electrical World.*

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

TRINIDAD AND TOBAGO.—The following goods are free of duty: goods imported by or for the use of the Governor of the Colony or the Colonial Government; implements and tools; electric lighting machinery, machinery for railways and tramways including rails and rolling stock; steam boilers and parts thereof; all these if not imported for sale.

Electrical goods of all kinds not admitted free of duty as above, would be dutiable at the rate of 10 per cent *ad valorem*. The cost of goods for the purpose of ascertaining the amount of *ad valorem* duty to be paid is calculated, if the goods have been purchased by the importer or consignor thereof, on the price charged for the goods by the vendor thereof as verified by the genuine invoice, and if procured otherwise than by *bona fide* purchase, the cost is calculated as the actual market value or wholesale price of the goods at the time of exportation to the Colony in the principal markets of the country whence imported; no discounts or deductions from the value of any goods chargeable with *ad valorem* duty will be allowed unless such discount or deduction is clearly shown on the invoice or unless the same be verified by the signature of the manufacturer or merchant.

N.B.—No person or corporation may use or establish any apparatus or installation for the purposes of wireless telegraphy without a licence from the Governor.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

4,821. "Electrically operated signs and the like." A. T. Dowdell and J. S. Hecht. February 27th.

4,865. "Switches." J. Böck. February 27th.

4,870. "Incandescent electric lamps." G. L. M. Dorwald. February 27th.

4,889. "Electric clocks." C. Fery. (Convention date, March 1st, 1910, France.) February 27th. (Complete.)

4,896. "Ceiling or wall roses for electric lights." H. Maddick. February 27th.

4,911. "Transformers." F. B. Koopman and Pontelec Welding Patents, Ltd. (Divided application on 10,964/1910, April 30th.) February 27th. (Complete.)

4,915. "Astatic control of electric regulators." Akt.-Ges. Brown, Boveri et Cie. February 27th. (Complete.)

4,917. "Press moulds for the manufacture of insulators with more than one petticoat." J. P. Dahl-Jensen and Akt. Bing & Grondahl's Porcellaensfabrik. February 27th. (Complete.)

4,920. "Telegraphic systems." P. Faielle. (Convention date, February 27th, 1910, Italy.) February 27th. (Complete.)

4,922. "Electrical contact device for mine or other signalling." G. S. Weymouth. February 27th. (Complete.)

5,005. "Electric circuit controlling apparatus for train lighting and similar systems." Electric and Ordnance Accessories Co., Ltd., E. H. M. Langley and E. W. Price. February 28th.

5,012. "Electric circuit-controlling apparatus for train lighting and similar systems." Electric and Ordnance Accessories Co., Ltd., E. H. M. Langley and E. W. Price. February 28th.

5,061. "Manufacture of incandescent electric lamps." "Z" Electric Lamp Manufacturing Co., Ltd., and F. Hoge. February 28th.

5,111. "Electric arc welding." A. P. Strohmenger. March 1st.

5,133. "Screwed nuts for securing electrical wires or other purposes." March 1st.

5,136. "Insulation of apartments." J. Doyle. March 1st.

5,140. "Smelting furnace with electric refining hearths connected thereto." A. Helfenstein. (Convention date, March 10th, 1910, Germany.) March 1st. (Complete.)

5,142. "Method and apparatus for the measurement of the specific resistance of electric conductors." Eversheed & Vignoles, Ltd., and S. Eversheed. March 1st.

5,154. "Manufacture of incandescent electric lamps." G. L. M. Dorwald. March 1st.

5,165. "Insulating material." British Thomson-Houston Co., Ltd. (General Electric Co., U.S.) March 1st. (Complete.)

5,166. "Control of electrically-driven printing presses and the like." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts Ges., Germany.) March 1st.

5,177. "Flexible electric conductors." E. Thornton. March 1st.

5,187. "Spark-dischargers for wireless telegraphy." J. G. Balsillie and British Radio-Telegraph and Telephone Co., Ltd. March 1st.

5,189. "Electric current distributing systems." C. H. Merz and P. V. Hunter. March 1st.

5,190. "Electrical transformers." A. F. Berry. March 1st.

5,227. "Incandescent electric lamps." Acton Lamp Co., Ltd., and T. W. Lowden. March 2nd.

5,228. "Overhead conductors of electric tramways, railways and railless road carriages and the like." H. L. Turner. March 2nd.

5,247. "Arrangements for the cooling of rotors of electrical machines." Siemens-Schuckertwerke G.m.b.H. (Convention dated March 2nd, 1910, Germany.) March 2nd. (Complete.)

5,248. "Apparatus for use in wireless telegraphy." E. F. Huth G.m.b.H. and R. Hirsch. (Convention dated August 3rd, 1910, Germany.) March 2nd. (Complete.)

5,259. "Electrical telescopy." B. Rosing. March 2nd. (Complete.)

5,264. "Manufacture of carbon pencils and the like for electric lamps, of material for electric resistances and of material for other purposes." G. E. Heyl. March 2nd.

5,267. "Electrical measuring instruments." E. Weston. (Divided application on 17,091/10, July 18th.) March 2nd. (Complete.)

5,269. "Control of electric motors." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts-Ges., Germany.) March 2nd. (Complete.)

5,309. "Water heating by means of electricity." W. A. Toppin. March 3rd.

5,384. "Electrical massage apparatus." R. Hacking. March 3rd.

5,385. "Aeroplane electric-dirigible." V. Dimitrescu. March 3rd.

5,418. "Electric light standards." E. G. Byng and J. H. Collings. March 4th.

5,427. "Electrically-controlled fastenings for railway carriage and other doors." C. R. Allen. March 4th.

5,442. "Electrical contact-making devices." G. St. John Day. March 4th.

5,457. "Generation, transformation and utilisation of electric energy." J. Maes. March 4th. (Complete.)

5,458. "Electrical resistances." A. H. Curtis and Adams Manufacturing Co., Ltd. March 4th.

5,459. "Dynamo-electric machines for motor vehicles." W. A. Trier. March 4th.

5,486. "Transmission of light pictures in electrical, telescopic, and similar apparatus." B. Rosing. March 4th. (Complete.)

5,490. "Automatic regulators for electric circuits." W. E. Lake. (United States Light and Heating Co., United States.) March 4th. (Complete.)

5,499. "Automatic electric regulators particularly applicable to lighting circuits." W. E. Lake. (United States Light and Heating Co., United States.) March 4th. (Complete.)

5,502. "Automatic arc lamp for light projections." A. Blondel. March 4th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Electric Controllers. J. G. Childs and T. S. Hill. 3,093. February 8th.

Making of Sparking or Ignition Plugs for use in Gas or Petrol Engines and the like, for Motor Vehicles or other purposes. J. A. Mason. 3,161. February 9th. (August 9th, 1910.)

Electric Meter Systems. H. W. Handcock and A. N. Dykes. 3,294. February 10th.

Manufacture of Brushes for Dynamo-Electric Machines and other Carbon Articles. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.) 3,336. February 10th.

Appliance for Automatically, Electrically and Mechanically Connecting and Suspending an Arc Lamp, Electrolier, or other Weight. O. R. Williams and J. Stevenson. 3,361. February 11th.

Employment or Running of Electric Lamps on Alternating-Current Circuits. A. W. Ashton. 3,518. February 12th.

Electric Typewriting or Stamping Machines. L. Pratschker. 4,359. February 22nd.

Magazine Arc Lamps. Johnson & Phillips, Ltd., and J. Brookie. 4,885. February 26th.

Arrangement of the Governing Mechanism of Electrically or Mechanically Driven Machines with Variable Numbers of Revolutions. Maschinenfabrik Oerlikon. 4,950. February 28th. (June 28th, 1909.)

Apparatus for the Production and Maintenance of Long Electric Arcs. G. W. Johnson. (Chemische Fabrik Griesheim Elektron.) 5,934. March 9th.

Electrical Speed Indicator for Measuring the Speed of Rotating Shafts. S. Lando. 6,256. March 12th.

Controlling Devices for Electric Motors. T. Barnard and G. C. Edwards. 6,535. March 18th.

Electromagnetic Circuit-Breakers and means for Resetting the same from a Distance, and Signalling Devices combined therewith. Adams Manufacturing Co. (Cutler-Hammer Mfg. Co.) 8,225. April 5th.

Electrical Plug Connections. R. H. Davis and Siebe, Gorman & Co. 8,977. April 13th.

Regulation of the Power Factor in the External Circuit of Polyphase Electric Machines. Siemens Bros. Dynamo Works. (Siemens-Schuckertwerke.) 10,913. May 3rd.

Motor Controllers and like Electric Switches. Adams Manufacturing Co. (Cutler-Hammer Mfg. Co.) 11,184. May 5th.

Armouring for Electric Wires or Cables. C. A. Vandervell. 11,978. May 14th.

Dynamo-Electric Machines. O. I. Blathy. 12,594. May 24th. (May 27th, 1909.)

Electric Furnaces. J. Thomson. 15,167 and 15,168. June 23rd. (September 1st, 1909.)

Control of Electric Motors. Allgemeine Elektricitäts Ges. 15,426. June 27th. (June 28th, 1909.)

Electrodes of Apparatus for Electrifying the Head of a Patient. A. Aub. 15,634. June 29th. (August 2nd, 1909.)

Electric Overload Indicators. Gilliatt and Excess Indicator Co. 18,742.

Fittings for use in Connection with Electric Incandescent Lamps. A. H. Midgley and C. A. Vandervell. 18,916. August 11th.

Combined Fuse-Box and Switch for Electric Circuits. P. Druseidt. 19,930. August 29th.

Electricity Meter for Registering Maximum Consumption. Allgemeine Elektricitäts Ges. 20,446. September 1st. (September 3rd, 1909.)

Magnetic Separators. M. Ruthenburg. 21,031. September 9th.

Automatic Electric Tumbler Switches. C. W. Denny and W. H. Flood. 26,737. November 17th.

Magneto-Electric Ignition Machines for Internal-Combustion Engines. Firm of Robert Bosch. 27,168. November 22nd. (October 29th, 1910.)

Electric Plug Couplings. J. Kalamba. 27,248. November 23rd. (March 7th, 1910.)

Filament Supports for Electric Glow Lamps. Lichtwerke Ges. 27,710. November 28th. (November 27th, 1909.)

New Cable Works in England.—The firm of Pirelli and Co., of Milan, which has an ordinary share capital of £420,000 and bond capital of £120,000, proposes to make a fresh issue of £140,000 in new shares and a similar amount in new bonds. It is reported in Milan that the company intends to utilise the fresh capital for the establishment of branch works in England.